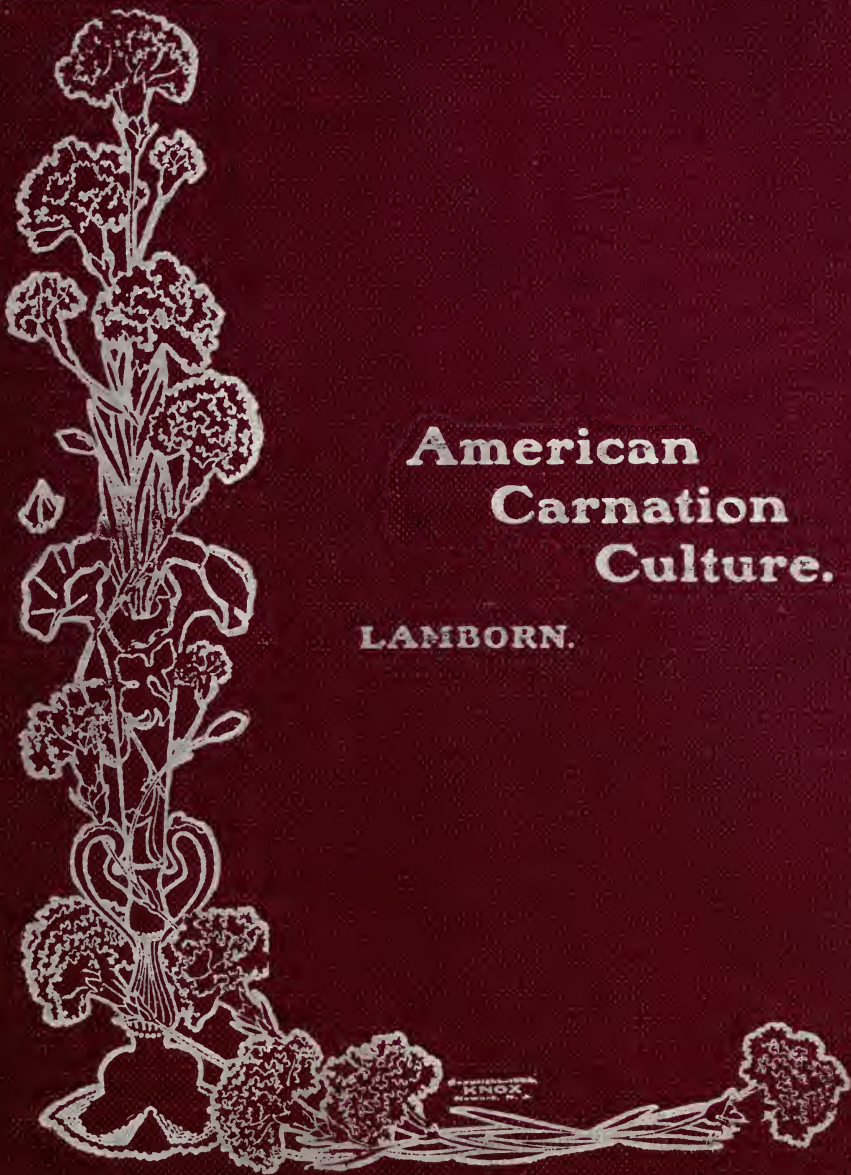


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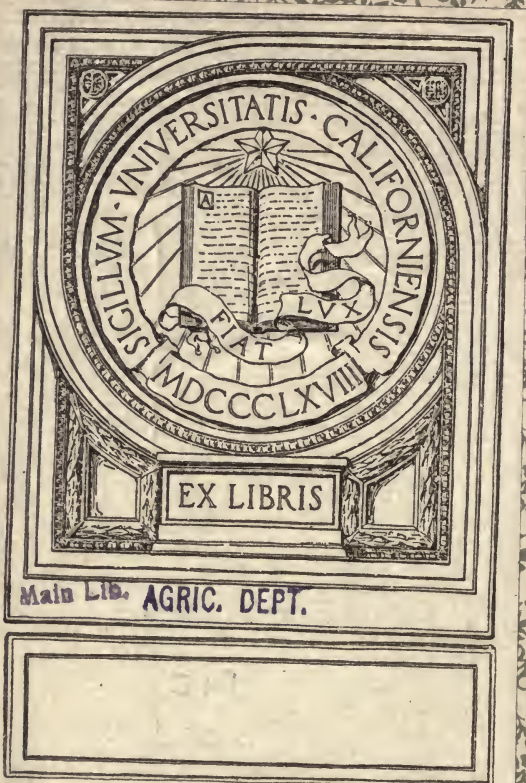


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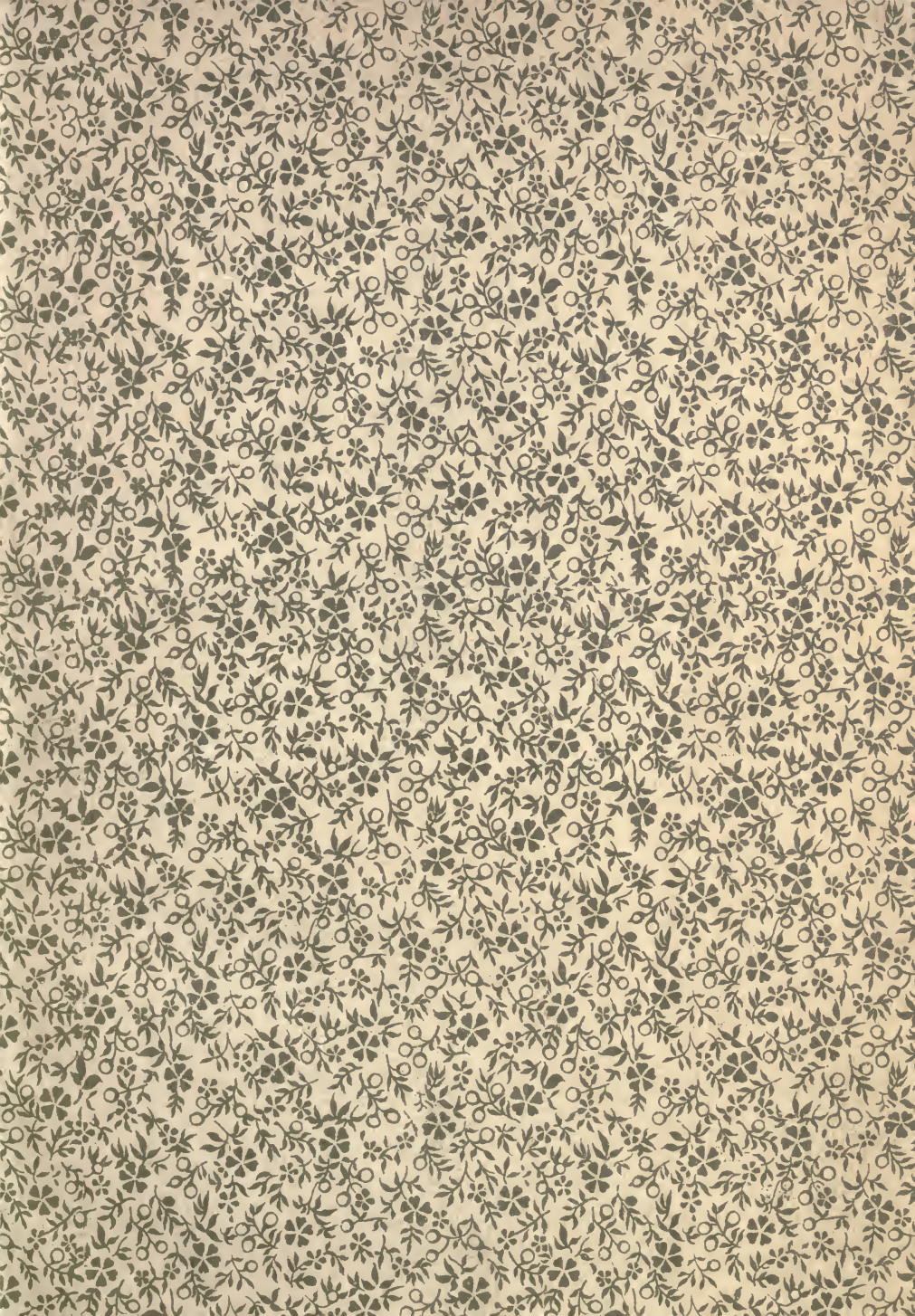
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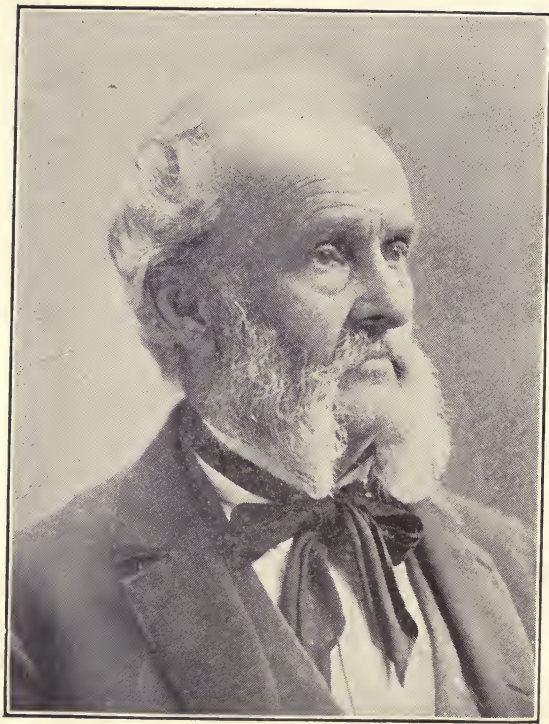


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Levi Leslie Lamborn, M. D.

American Carnation Culture.

THE EVOLUTION OF
DIANTHUS CARYOPHYLLUS SEMPERFLORENS.

ORIGIN, HISTORY, CLASSIFICATION, VARIETIES,
PROPAGATION, DISEASES, REMEDIES, CARE,
CULTURE AND COMMERCIAL IMPORTANCE.

BY L. L. LAMBORN.

"Flowers are the smiles of nature."

FOURTH EDITION.
REWRITTEN AND BROUGHT COMPLETELY UP TO DATE.

ALLIANCE, OHIO,
LO RA L. LAMBORN, PUBLISHER.
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To H. Weber, of Oakland, Md.,
with whom originated Genevieve Lord,
Egypt and Norway; without consultation,
personal acquaintance or authority, but with
mutual love and admiration for the Divine
Flower, I dedicate the little I have
learned and written here.

271660

"GENEVIEVE LORD."

CONTENTS.



PROLOGUE,	- - - - -	9
I.—Origin of the term <i>Dianthus</i> . Name of a genus of plants History from Theophrastus to Alegatiere. Arrest of botanical knowledge for centuries.	- - - - -	13
II.—History of Carnations from Alegatiere, 1844, to Charles Starr, 1890. Peculiarities of the new species. First importations. First cross fertilization in America.	- - - - -	18
III.—Carnations from Charles Starr to the 2nd year of the 20th century. Importations into the Carnation zone. Number originated and introduced. Analysis of the list.	- - - - -	23
IV.—New Carnations. Hybridizing and crossing. How to fertilize. Chances for success. Opinions of experts. Restraining and progressive forces.	- - - - -	29
V.—Life lives in cells. Continuing life by cuttings. The conditions required. Difference between a cutting and a seedling. Kind of cuttings. The time to strike them.	- - - - -	39
VI.—Carnations in the field. Precautions against failure. Prepara- tions for their field life. The sanitarium for Carnations. Number of plants to an acre.	- - - - -	45
VII.—Carnations from the field to greenhouse beds or benches. Early and late lifting. In wet and dry weather. Bench planting. Distance apart. Watering and shading.	- - - - -	48
VIII.—Solid beds. Raised benches with wooden, slate, and tile bot- toms. Testimony of Carnation growers as to their prefer- ences. Proper soil for beds and benches.	- - - - -	52
IX.—Tying up, or supporting Carnation flowering stems. The better plan. Disbudding Carnations. A matter of market. A conservation of vital energy.	- - - - -	56

X.—Professor Arthur on plant respiration. Surface view of epidermal cells of a Carnation leaf. Section cut through a Carnation stoma. Physiological demand of Carnations for fresh air. - - - - -	58
XI.—Overhead watering. Surface watering. Sub-watering. Cost of beds and benches. Opinions of growers on their relative merits. - - - - -	61
XII.—Topping Carnations. Shipping flowers and cuttings. Enigma of flowers "going to sleep." Opinions of eminent Carnationists. Functions of petals and their preservation. -	65
XIII.—Is quantity of bloom being sacrificed for quality? Are Carnations growing less productive? Records quoted. Blooms per plant. Comparisons made. - - - - -	70
XIV.—Classification of Carnations based on colors. European system of nomenclature. Ratio of colors in Carnations. Virile colors. Sentiment of colors. - - - - -	73
XV.—Growing Carnations under glass through the summer. Why a higher grade of flowers? Increased cost. Advanced price, an earlier market, the compensation. - - - - -	80
XVI.—Sunlight and ventilation the prime factors in a Carnation house. Butting glass. Heating. Heat radiating surface necessary to glass surface. Tables. - - - - -	82
XVII.—Fertilizers for Carnations. Formulas. Effect of excessive nutriment on Carnations. Exact analysis of a given quantity of Carnation roots, stems and leaves. - - - - -	89
XVIII.—Diseases of Carnations resulting from insects: Greenfly, (<i>Rhopalosiphum Dianthi</i>); Red Spider (<i>Tetranychus Telarius</i>); Nematodes (<i>Heterodera Radicicola</i>). Thrips. Their remedies. - - - - -	94
XIX.—Diseases of Carnations resulting from Fungi: Rust (<i>Uromyces Caryophyllinus</i>); Wet Stem Rot (<i>Rhizoctonia</i>); Dry Stem Rot (<i>Fusarium</i>); Spot Disease (<i>Septoria Dianthi</i>) Their remedies. - - - - -	100
XX.—Nutrient diseases. Barren Carnations. Cohering petals. Purple Joint (<i>Rosette</i>). Ruptured Calyxes. Double flowering Carnations. Incidental pests. - - - - -	107

XXI.—Do varieties of Carnations deteriorate and die? Continuing life by cuttings a natural and virile method. As preservative as reproduction by seed.	- - -	110
XXII.—Life lives in cells. Conception is by fission of cells. Origin of bud variations or "Sports." Bi-sexual life in Carnations. In all Monœcious class of plants.	- -	113
XXIII.—Geographical Botany of the commercial Dianthus. Its type in Germany, France, England, California, on the isotherm of 50° mean temperature.	- - - -	118
XXIV.—Carnations the product of adaptation by selection. Survival of the fittest. Origin of varieties. Basis of species. Foundation of genera. Essence of orders.	- . -	122
XXV.—Map of the zone of the semperflorens Carnation. Isothermal lines. Climatic conditions. Every type of species confined to its own isotherm. Carnations 50° mean heat.	-	126
XXVI.—Map of 50° isotherm normal climate for Carnations. List of the best Carnations since the birth of Astoria. Names, colors, originators, place of their birth.	- -	131
XXVII—New species of Carnation. Distinctive features of Dianthus Superba, and Dianthus Semperflorens. They require different cultural treatment.	- - - -	137
XXVIII—Carnation brevities. Multum in parvo.	- -	144
XXIX—Popular Carnation Culture. Carnations in every cottage. How amateurs can grow them for lawn adornment. Table decorations and boutonnieres.	- - - -	165
XXX—Epilogue. Evolution of the five-petaled pink.	- -	171

PROLOGUE.



THE first edition of AMERICAN CARNATION CULTURE was published in 1885, before the organization of any national floral societies, or the establishment of Trade Journals, to collect and collate facts. The only medium or source of mutuality among carnation growers at that time was by brief, sententious catalogues. The author purchased and grew nearly 200 varieties of carnations then originated, to obtain some experimental data upon which to found the work. He then claimed and now claims AMERICAN CARNATION CULTURE was the first and only work ever published in historical form on the American remontant type of carnations.

Dodwell published a work in England about the same time with only a few pages devoted to the Alegatiere type of carnations. Hogg wrote a work in 1820 on the culture of the carnation pink. Asa Gray wrote a pamphlet on carnations in the thirties, Gard in 1597, Busler in 1813, John Ray in 1713, Philip Mullens in 1752, William Curtis in 1788, Martin in 1807, and others, up to 1840, speak and briefly treat of carnations. But none of these refer to the species I seek to deal with, for it was not originated until 1856.

The superintendent of the Agricultural Department of the United States, estimates from the census of 1900 that the glass surface of greenhouses in America amounts to 300,000,000 superficial square feet, equaling an area of about 8000 acres. There are 15,000 floral establishments that rise to the commercial importance of requiring constantly the employment of two men, and giving support to 30,000 people. This calculation does not include thousands of small houses, and conservatories for growing plants and

flowers for private use and incidentally local sales. The superintendent estimates that the total sales, or output from the glass considered, amounts to 22,500,000 dollars yearly. The item of roses, in this aggregate, amounts to 6,000,000 dollars; carnation flowers, 4,000,000 dollars annually; and the number of carnation flowers sold equals the number of roses. A correspondent writes that 3,000,000 carnations are planted in the field this spring (1901) tributary to the Chicago market.

There are two establishments, each with a quarter of a million feet of glass, devoted largely to carnations. They each plant nearly twelve acres in the field, and house two hundred and fifty thousand plants in the fall. Millions of dollars are now invested in growing carnations.

The first carnation plant sold in America was in March, 1864. What an amazing development in a humble industry in less than forty years. The end is not yet. The carnation crosses the threshold of the 20th century with queenlier step, greater grace, and sublimer beauty than ever before.

Dianthus is the coming flower. Its acclaims for the Throne of Flora is echoing in the tomorrows. *Dianthus* is embodied evolution. It contains imprisoned with its mystic life-force the power of marvelous evolvment, the prophecy of untold progress. It started on its triumphant march a petty plant, with five little flower leaves, glued to the grimy earth from which it sprang; now fifty dawn-lit, iridescent petals nestle around its anthers and snare the admiration of the world with the witcheries of their colors. It has kept abreast with the progress of the ages, and is responsive to the magic touch of the florist's art. The carnation will live and grow in public esteem as long as men love the perfume of spices, pay homage at the gates of grace, and bow at the shrine of beauty.

In this work the amateur will find a guide for his efforts; the inexperienced carnation grower, directions for success; the practical cultivator, sufficient to interest him; the future historian of *Dianthus*, facts rescued from oblivion; and the vegetable physiologist, a philosophy close along the lines of plant life.



CRESSBROOK.

This Carnation received the phenomenal rating at Baltimore, in February, 1901, by such critical and competent men, acting as judges, as Wm. Scott, Wm. Nicholson and Patrick O'Mara, of 94 points, within 6 points of perfection. This judgment was confirmed by men of equal acumen in Boston a month later. Cressbrook originated with Mr. C. Warburton at Fall River, Mass. It will be put on the market in the spring of 1902.

CHAPTER I.

THE ORIGIN OF THE TERM DIANTHUS—THE NAME OF A GENUS OF PLANTS—HISTORY FROM THEOPHRASTUS TO ALEGATIERE.

THREE hundred years before the Christian Era, Theophrastus, a disciple of Socrates, philosopher and moralist, lived in Greece. He published a little work on the Flora of his native land; he had no conception of genera and species, and divided all plants into three classes; Aquatic, Flowering Plants, and Culinary Herbs. He wrote in Greek, and was the first author to mention and name a little procumbent, five petaled flowering plant; he called it *Dianthus*, from two Greek words, *Dio* (divine), *anthos* (flower), meaning Divine flower.

In the evolution of botanical science Theophrastus was followed by Discorides, Pliny, and Galen, in the second century. From this period until the sixteenth century botany was not enriched by a single work of merit. During this long interval of time, the little light that had been thrown on the vegetable kingdom by a few early authors became more dim and obscure.

In the sixteenth century, Gesner of Germany was the first to establish families of plants founded on resemblances, or affinities, and his labors awakened new interest in botanical pursuits. Linnæus lived in the eighteenth century and gave a new nomenclature to botanical science. He described with precision every organ of a plant now known, and gave them appropriate names which are still closely adhered to. His classification of the vegetable world is called the "Artificial System." Linnæus is called the "Prince of Naturalists." With a few admitted defects, no arrangement of the plants has yet been offered as simple and effective as his.

After Linnæus, Jussien proposed a system of classification founded upon certain distinctions which was found to be universal,

and his arrangement has been called the "Natural System" of botany.

It is of interest to inquire into the botanical classification of a plant that has lived with a changeless name for two thousand three hundred years in the floral records of the world, and whose flowers in forty years, in this country, have risen in commercial importance to four millions of dollars annually.

According to the Linnæan System (improved by Lindley,) of plant classification, the carnation of commerce belongs to the Caryophyllacie tribe of plants, of the *Dianthus* genera, and is one of the twenty natural orders of the Polypetalous division of plants. As such it is technically described as an *Herb*, with opposite, entire leaves; *Flower*, regular, both terminal and axillary; *Sepals*, 4 or 5, distinct, or adhering; *Petals*, 4 or 5; *Stamens*, as many as the petals opposite them, sometimes twice as many; *Ovary*, composed of 2 to 5 carpels; *Stigma*, 2 to 5, sessile, filiform; *Fruit*, a capsule opening at the apex; *Seeds*, indefinite in number; *Embryo*, curved or coiled around the outside of a mealy alburnum.

There are enumerated over 200 species of the *Dianthus* genera of plants, none of which are natives of America, if *Dianthus Repens* is excepted, which is found on the coast of Kotzebues Sound. *Dianthus Armenia*, and *Prolifica* found in the eastern states, are introduced, and troublesome weeds, as is *Dianthus Stellaria Media*, or the common Chickweed that is so vigorous in the cooler months of autumn. There are only four species in America which are regarded of any floral value. They are:

1.—*Dianthus Barbatus*. Synonyms: Sweet William, etc.

2.—*Dianthus Chinesus*. Synonyms: China Pink, D. *Diadema*, D. *Lancinatus*, D. *Headwigii* are sports of this variety, and in a bed of a thousand seedlings it is hard to find two alike.

3.—*Dianthus Plumaris*. Synonyms: Garden Pink, Bunch Pink, Florists' Pink, Cushion Pink, Pheasant-eye Pink, *Dianthus Hortensis*, etc.

4.—*Dianthus Caryophyllus*. Synonyms: Clove Pink, Clove Gilly Flower, Carnation, Tree Carnation, Remontant Carnation, Semperflorens Carnation, Everblooming Carnation, Forcing Pink,

Hardy Pinks, Sweet May Pinks, Scotch Pinks, Picotees, Hybrid Perpetual Pinks, Self, Fancies, Bizzars, Marguerites, Flakes, Malmasons, and a score of other local names in Europe and America are given to the interminable varieties of the four mentioned primal species of the *Dianthus* genus of plants. All pinks have a dwarfer growth than carnations, their leaves are more profuse and grass-like, they grow in tufts, 10 to 15 inches high, bloom profusely in a single crop, and will not stand forcing.

The lacings, shadings, blendings and markings, on the petals of pinks are always transverse; those on carnations are parallel with the axis of the petals.

In a work devoted exclusively to a single species of the *Caryophyllus* family of plants, I can only generalize the statement that classes, orders and genera of the botanies are but divergent varieties of parent plants, with their habits and natures modified and rounded by different enforced climatic condition into so-called species. The environments of *Dianthus* in Germany have differentiated it into Bizzars, Selves, Flakes and Fancies, which types are perpetuated by layering the branches. In France they are modified into Malmasons, Marguerites, Border Pinks, and the types continued by layering.

In 1597 Gard declared that there were so many varieties of pinks that "a large volume would not contain a description of them all." In 1613 Bessler figured a carnation flower at $3\frac{1}{2}$ inches in diameter. In 1702 a John Ray catalogued 360 distinct kinds of carnation pinks. In 1752 Philip Millens in his "Gardeners' Dictionary" advised splitting the calyxes of carnations with a knife to avoid their rupturing. In 1788 William Curtis figured a Bizzars at $3\frac{1}{4}$ inches across, and added, "that it was not the most perfect flower of the kind, either in form or size."

In 1807, Martyn fixed $3\frac{3}{4}$ inches as the largest type of a carnation flower, on a strong, stiff stem from 30 to 45 inches long. In 1840, carnations of the Malmason type in Europe are spoken of as producing flowers 6 inches in diameter, which is confirmed by Mr. Hill, who visited Europe in the interest of the carnation a few years back.

The question is asked why were those magnificent carnations with monstrous corollas spoken of in history as existing from fifty to two hundred years ago discarded. The answer is, they were not carnations at all, in the sense the term is now used. They had none of the elements that make Alegatiere's new species valuable, they were not perpetual bloomers, and could not be forced to yield their flowers in a season when they were wanted. They were highly stimulated pinks, Titanic flowering Picotees, monstrous Selves, Bizzars or Fancies, which produced a few prodigious blooms and died in the throes of parturition.

In 1775, Linnæus having differentiated the various organs of flowers and particularized their functions, seemed to make artificial pollenization possible, and experiments were successfully made on many species of flowers. Mons Dalmias, Schmitt and Alegatiere, of Lyons, France, were the first men to attempt it on the domesticated and improved species of cultivated carnations chronologically referred to. Their crossings and re-crossings continued from 1844 to 1856, when Alegatiere evolved the first type of the remontant carnation. The product of his crosses had stiff lower stems, flowers 2 inches in diameter; they would bear forcing and bloom continuously. In 1894 John Thorp predicted that this species of carnation would evolve a flower 4 inches in diameter.

The conditions in America have developed the remontant carnation, the California thermal carnation, and also improved the hardy pink. These differences have been fixed by heredity through generations of plant life, prompted by local climatic conditions, and are not successfully transferable from one of these localities to another without requiring a corresponding period of adaptation. No European or California carnation has ever been imported into the remontant zone of America, and been immediately successful. The parents of the species with which we have to do, grow wild through southern Europe. It was named *Dianthus Caryophyllus* by Linnæus, from the strong clove fragrance of its flower; *Caryophyllus* being the botanical name of the clove, it literally means the Clove Dianthus. It had nothing to distinguish it from its related species but its exhilarating perfume. It is

hardy above zero, while most of its cognate species are hardy below zero. Its primitive habits stand today in strong contrast with its evolved progeny.



DILLON'S QUEEN LOUISE.

CHAPTER II.

HISTORY OF CARNATIONS FROM ALEGATIERE TO STARR, 1844 TO 1890.

IN 1876 the question arose, "where, how, when and by whom, was the perpetual carnation originated?" Jene Sisley, an eminent and reliable horticulturist of Monplaisir, Lyons, France, under whose personal observation the facts transpired, wrote for the *Revue-Horticole*, a French journal, only ten years after the circumstances occurred, the facts attending the origin of the new species of carnations, in answer to the above question. In 1886, ten years later, Jene Sisley recapitulated the same facts, and his article was published in the 14th number of the *American Florist*.

The particulars cannot be more tersely stated than in the language of Jene Sisley and we give his article verbatim.

"I think it may be of interest to horticulturists and amateurs, to be informed of the carnation's history which I published ten years ago in a paper of limited circulation. According to several horticultural writers, the carnation was cultivated two thousand years ago, but we know no more of what was practiced in those times than in any other science; it is only since the beginning of this century (19th) that the facts of nature have been really studied, and we can only relate what has lately been practiced.

The perpetual carnation was originated at Lyons, France. It was M. Dalmias, a celebrated amateur gardener to M. Lacene, founder of the first Horticultural Society of that region, who obtained the first really constant blooming carnation, in 1842. He sent it out in 1844 under the name of *Atim*. It was the production of an artificial fecundation, of a so-called species known by the vulgar name of carnation of Mahon, or of St. Martin, the latter because it was blooming by the middle of November, and fertilized by carnation Bielson.

This first gain was successively fecundated by Flemish carnations, and in 1846 Dalmais obtained a great number of varieties of all colors.

M. Schmitt, a distinguished horticulturist of Lyons, followed M. Dalmias, and obtained several fine varieties like Arc en eiel, and Etolle Polaire, which were cultivated for several years, but do not now exist, having been superseded by better kinds. In 1850, a disease having destroyed his collection, M. Schmitt abandoned their culture. Soon after, Alphonso Alegatiere undertook the hybridization of carnations, and in a short time obtained great success, dotting that series with a great many varieties, all particularly dwarf and obtained a very great improvement by creating those with stiff lower stems, about 1856. We can say Alegatiere originated a new species. He also upset the old system of propagating by layering and has proved that propagation by cuttings is the best and most reasonable method, produces the best plants and thus justified my saying that layering is the infancy of the horticultural art. He also demonstrated that nothing is easier than propagating carnations by cuttings, and the best time to strike them is in January and February, and the best mode is to put them in a bench of fine sand, in a span roof house, without bell glasses, the benches underneath being heated by hot water pipes, to 60 or 70 degrees, and the cuttings will strike root in from three to four weeks. The sand must be kept damp and the cutting syringed every day. They can be placed out in April or May, and will make fine plants to bloom in Autumn."

JENE SISLEY,

Feb., 1886.

Monplaisir, Lyons, France.

Several species of the pink family of plants grew wild along the Mediterranean shores and in southern Europe, that had been domesticated and cultivated for the beauty of their flowers. Their strains, from this cause, became much improved. Linnæus, the great naturalist, in the first of the 19th century described the male and female organs of plants and the fertilizing properties of the pollen. This discovery led to the possibility of fecundation of plants being accomplished by artificial means. The universal botanical interest Linnæus awakened led the curious and ingenious to experimenting with artificial pollenization. Hybridization was accomplished, and cross fertilization became common with many species of plants.

It is evident that Atim was the first recorded name of the perpetual blooming carnations, the Adam of the race. But a new species does not spring at once into existence full armored, booted

and spurred. The boundary between Atim and its successors and Atim and its parents was vague and ill-defined. It required time and heredity to round its successors into a species. Varieties are the parents of species. Nature starts a variety at a single fructification, but it requires generations of plant life to fix the features of the variety into a distinct class. It has taken years to eliminate ancestral vestiges from carnations, and unfold their higher possibilities; and the end is not yet. Racial heredity is so insistent that as late in the carnation's history as the first edition of AMERICAN CARNATION CULTURE the author found it necessary to classify it into late and early, constant and cropping, short and long stemmed classes, which divisions were founded on the retained relics of their pre-natal types.

The species of carnation evolved by the labors of Dalmais, Schmitt and Alegatiere had three important features of difference from all its progenitors.

First. It was structural, had stiffer lower stems, and its ancestors had a sprawling and procumbent habit.

Second. It kindly responded to the stimulus of artificial heat called *forcing*, which is death to its parental and all its generic relations.

Third. It possesses inherently the power of distributing the short-lived and immense single crop of bloom peculiar to its tribe of plants throughout its entire mature life. By reason of these three distinguishing peculiarities it has been called the *perpetual* carnation.

It has been called the *tree* carnation, because its stems are longer, more erect, rigid and tree-like than any of its associate species. It is called the *remontant* carnation from its nature to continually re-mount itself with flowers. It is called the *semper-florens* carnation from *semper*, (continuously) and *florens* (flower,) meaning continuously flowering. It has been called the *clove* carnation because of the clove fragrance of its flower.

I have made diligent effort to obtain facts relating to the introduction of carnations into America, and the result leaves little that is legendary. A firm of florists on Long Island, composed

of Zeiler, Gard and Dailedouze, in 1858, imported from Lyons, some seed cross-fertilized by Alegatiere, who after Dalmias and Schmitt became the representative of the new species of carnations in France. So far as tradition and old records throw light on this invoice of seed, but little came of it. There is not a single carnation bearing a name until after this firm's second importation, in 1862.

In March, 1864, two years later, this firm issued a catalogue which listed 125 named varieties of carnations. These were evidently the product of seedlings or cuttings obtained from their seedlings, imported the previous year. These varieties the firm offered for sale in five-inch pots. The late Peter Henderson, father of American horticulture, bought fifty of these plants, paying Zeiler, Gard and Dailedouze \$1.50 a piece for them, the first sale of carnations of any significance occurring on this continent.

Louis Zeiler obtained from Lyons, France, three batches of carnation seed, and with the last in 1864, two plants, a pink and a white, named respectively La Puritie and Edwardsii. It is an error that the white La Puritie, cultivated until 1890, was the pink La Puritie imported by Zeiler. There has been in cultivation four La Purities, red, pink, white and variegated. Edwardsii was doubtless not continued by cuttings. It was the practice with the few florists, at populous points on the sea board, to raise their carnations from seed and grow them in pots; bench culture was not then thought of. White carnations for years went under the name of Boule de Neige, Peerless, Avalanch, Snow Ball, White Perfection, Snow White, Edwardsii, etc.

According to the census of 1860 there were but 112 floral establishments in the United States at the advent of carnations in this country, and a large percentage of these were indifferent about a new flower of European origin.

Astoria passes on the roster of publicity in 1864 as the first native born carnation. It is credited to Wilson, and is possibly a product of the 1862 or 1864 importation of seeds.

There followed in 1866, La Puritie and Edwardsii. In 1866 these imported plants are credited to Zeiler, who merely imported

them. They were the best productions of Alegatiere's cross-fertilizing skill.

During this long time there was a dearth of new kinds of carnations continuing until 1875, when Charles Starr cross-fertilized and obtained Lady Emma. In 1877 he obtained Chester Pride; and in 1878, Buttercup. Then rapidly followed until his death (Dec. 24, 1891) a series of over 50 marvelous enrichments to the floral wealth of carnations.

Charles Starr in 1873, caused to be made the first engraving of carnation flowers in America, and possibly in the world, which was sent to the writer to illustrate the first edition of AMERICAN CARNATION CULTURE, in 1885. (See engraving) He also wrote for the same work, the *only* scientific and practical treatise on the classification, propagation and culture of hardy pinks ever published in America. He was a devoted admirer of the Dianthus family of plants. His life was an epoch in their history. Zeiler, Gard and Dailedouze, of Flatbush, N. Y., first imported carnations to America. Charles Starr, of Avondale, introduced and made them famous to the lovers of the beautiful,

CHAPTER III.

CARNATIONS FROM STARR TO SECOND YEAR OF TWENTIETH CENTURY—IMPORTATIONS—YEARLY INTRODUCTIONS— NUMBER OF NAMED KINDS—AN ANALYSIS OF THE LIST.

THE entire genus of the *Dianthus* family of plants is natives of Europe. Some of the indigenous species were hybridized and the product cross-fertilized by Dalmias, Schmitt and Alegatiere, which worked a revolution in their nature, and established a new species of the *Dianthus* genus of plants. There is not a variety of the pink tribe that will bear forcing and bloom continuously; but the varieties originated by Alegatiere, La Puritie and Edwardsii, are the great-grand-parents of all the remontant types of carnations in America today.

Since their introduction, forty-three years ago this spring, they have multiplied varieties to eight hundred named kinds. The originators' names of one hundred and twenty of this list are unknown; about one hundred of the number have been imported into the carnation belt from Europe, and seventy-five from California; in the list are thirty known bud variations, or sports, and six synonyms.

Things polarize at points. A hundred varieties of carnations have originated close to where Lady Emma, the first cross-fertilized carnation in America, germinated.

After January, 1897, I name yearly the most promising new introductions, and their originators' names. During forty years there has been concerned in the development of the carnation, one hundred and forty different practical observing men, who have furnished what they deemed acquisitions to the list of carnations.

Starr contributed,	55	Zeiler contributed,	9
Dorner “	43	Creighton “	9
Simmons “	40	Brinton “	7

Linton contributed,	32	Hautell contributed,	5
Thorp	" 26	Swayne	" 5
Shelmire	" 18	Wight	" 5
Hill	" 12	Larkins	" 5
Fisher	" 10	Lonsdale	" 5
McGowen	" 9		

Thirty originators have contributed less than five, and one hundred and twenty-seven originators have contributed but one. Many carnations were named but never disseminated, and many more were disseminated that proved worthless; about fifty in the list are marked improvements with strong individualized characters. The rest should quietly sleep in the catacombs of defunct carnations.

The first edition of AMERICAN CARNATION CULTURE, published in 1885, the author secured from the growers of carnations in fifteen different states a list of varieties they deemed most valuable at that time. They grew the following kinds, with preference in the order named:

Portia	Peter Henderson	Robt. Craig
Prest. De Graw	T. Mangold	Snowball
Buttercup	Chas. Henderson	Sunrise
Henzie's White	Mrs. Carnegie	Duke of Orange
Edwardsii	Queen of Whites	Seawan
Snowden	Scarlet Gem	Othello
Grace Wilder	Peerless	Astoria
Crimson King	Alegatiere	Pride of Penhurst
Grace Fardon	Century	Fisher's White
Chester Pride	Prest. Garfield	Sea Foam
Mrs. Joliff	Princess Louise	

The following comprises the varieties preferred by the growers in the first year of the twentieth century, fifteen years later. Some growers, responding to enquiries this year, have named three or four kinds of the same class of colors they grow. To generalize and economize space, the first one named has been chosen as their preference. The introductions of 1900 and 1901, not being sufficiently tested by growers, are not named in the twentieth century list of preferred kinds cultivated.

WHITE
 White Cloud
 Elm City
 D. R. Nutting
 Flora Hill
 Mary Wood
 Eastern Star
 Lizzie McGowen
 Norway
 Glacier
 E. Crocker

SCARLET
 Crane
 Leopold
 Bon Ton
 Estelle
 Rosemont
 Jubilee
 Joost
 Lady Emma
 Portia

CRIMSON
 Roosevelt
 Empress
 Egypt
 New York
 Maceo
 Gomez

PINK
 Sampson
 Avondale
 Daybreak
 Joost
 Scott
 Triumph
 Marquis
 Chapman

YELLOW
 Golden Beauty
 Gold Nugget
 Eldorado
 Buttercup

VARIEGATED
 Bradt
 Olympia
 Lilly Dean
 Pingree

The above two list show that the entire list of cultivated carnations, even to the choicest varieties, are discarded, and new and improved kinds substituted, in the space of fifteen years. In the following lists of new carnations annually introduced, the leading ones only are named. It is worse than folly to rescue from oblivion the memories and names of dead carnations and lumber history with a long list that is never read.

Carnations Introduced in 1898.

CONCH SHELL—Grout.
 GENESEE—Harmon & Burr.
 ALBA SUPERBA—Burton.
 NEW YORK—Ward.
 GEN. GOMEZ—Ward.
 ETHEL WARD—Ward.
 EMILINE—Shelmire,

GOLD NUGGET—Dorner & Son.
 SERVIA—S. Fisher.
 BIRD-IN-HAND—E. Weaver.
 GEN. MACEO—Ward.
 QUEENS—Ward.
 PROGRESS—Shelmire,

GOLD COIN—Hancock & Son.	FIREFLY—Hancock & Son.
MARY A. WOOD—Dorner & Son.	MAUD ADAMS—F. Niquet.
HAPPY DAY—A. Wake.	KATHLEEN PANTLIND—Hopp & Smoke.
BON TON—F. A. Blake.	

Carnations Introduced in 1899.

ADMIRAL DEWEY—H. Echolz.	AMERICA—Hill & Co.
ANNA EASTBURN—L. B. Eastburn.	CHICAGO — Chicago Carnation Co.
DUKE OF YORK—Shelmire.	DOROTHY MANDELL—H. A. Cook.
EVANSTON—M. Weiland.	GENEVE LORD—H. Weber.
G. H. CRANE—Dorner & Son.	GOLD NUGGET—Dorner & Son
GOV. GRIGGS—I. Tiwell.	LUNA—American Rose Co.
LIBERTY—Shelmire.	MELBA—Craig & Son.
MARY A. BAKER—Eastburn.	MOORE'S CRIMSON—Moore.
MEPHISTO — American Rose Co.	OLYMPIA—J. May.
MRS. T. LAWSON—P. Fisher.	PROGRESS—Shelmire.
POTOMIE—American Rose Co.	MARQUIS—L. E. Marquisee.
S. S. PENNOCK—E. Weaver.	ADMIRAL SCHLEY—Fick & Faber.

Carnations Introduced in 1900.

BELLE BUTE—Aldous & Son.	HELEN GOULD — Kretschmer.
CLARA BURTON—Kretschmer.	OREGON—E. G. Hill & Co.
BRILLIANT—McConnell.	SUPERIOR — E. McConnell.
CALIFORNIA GOLD—Sievers & Co.	P. HEILIG—P. Heilig.
KEYSTONE—P. Heilig.	IRENE—Crabb & Hunter.
MME CHAPMAN—Crabb & Hunter.	ELEANOR AMES & MAY WHITNEY—Carmichael.
	CHRISTMAS ROSE—Heilig.

SAXON—S. Fisher.	DOROTHY FORBES—Heilig.
J. C. SIBLEY—P. Heilig.	BELLE VISTA—J. Allen.
CONQUEST—T. Capers.	ELM CITY—M. E. Kraus.
SIR T. LIPTON—H. B. Mc- Knight.	THE CRAWFORD—T. Greaves.
THE COPELY—T. Greaves.	MICHIGAN—A. R. Walker.
SYRACUSE—L. E. Marquisee.	YOUNG AMERICAN—T. J. Totten.
ALMA—Casper Aub.	

Carnations Introduced in 1901.

NORWAY (white), Weber & Son.
 EGYPT (scarlet), Weber & Son.
 ESTELLE (scarlet), Witterstatter.
 QUEEN LOUISE (white), Dillon.
 MIDNIGHT SUN (crimson), Weaver.
 LANCASTER (pink), Weaver.
 MRS. L. BEHN (white), Specht.
 MISS M. BEHN (pink), Specht.
 MISS F. SPECHT (scarlet), Specht.
 DELIGHT (pink), Dailedouze Bros.
 PROSPERITY (white), Dailedouze Bros.
 LORNA (white), Dorner & Son.
 DOROTHY (pink), Graves.
 CHALLENGER (scarlet), Hoffman.
 TWENTIETH CENTURY (pink), Hoffman.
 BRANDYWINE (white), Love.
 MANGUS (white), Lake.
 EMPIRE STATE (white), Marquisee.
 LENA (pink), Pyle.
 BEAU IDEAL (pink), Pierce.
 HOOSIER MAID (white), Rasmussen.
 WHITE ROSE (pink), Nichols.
 MRS. BIRD COLER (red), Molatsch.
 MRS. P. HEILIG (pink var.), Heilig.
 GEN. CHAS. MILLER (white), Heilig.

- HABERNMEHL (pink), Kuhn.
- MAID OF HONOR (pink), Binstead.
- SUNBEAM (pink), Chicago Carnation Co.
- BON HOMME RICHARD (white), Chicago Carnation Co.
- NYDIA (variegated), Chicago Carnation Co.
- PROLIFICA (pink), Chicago Carnation Co.
- GOV. WALLCOTT (white), Fisher.
- EASTERN STAR (white), Fisher.

New Carnations to be Introduced in 1902.

- CRESSBROOK (pink), Warburton.
- HEILIG'S (white), Heilig.
- MRS. NELSON (pink), Nelson.

The maximum diameter of the flowers of six of these varieties the originators assert to be 4 inches with canes from 2 to 3 feet long. Ten of the originators declare the flowers of their varieties *never* burst their calyxes. The startling prophecy of Thorp is realized, the four inch carnation flower is here.

CHAPTER IV.

HYBRIDS AND CROSSES—NEW CARNATIONS—HOW TO FERTILIZE—CHANCES FOR SUCCESS—OPINIONS OF EXPERTS.

CARNATIONS produce comparatively few seeds, most double flowers being barren. High culture modifies their generative organs, the stamens and pistils, into petals. Mr. Rudd reports having obtained 72 mature seeds from one pod, Mr. Dorner 116; but these are notable exceptions, from 10 to 20 being the more common number. Seed sown in the early fall will grow, stand the winter with little protection and bloom the following season. Most of them will be abnormal products and lapses into primitive single types. When an improved specimen is, by accident, obtained, the only known method of continuing the variety is by cuttings taken from this parent plant. The features of life sculptured in Nature's work-shop are never changed. The torrent of life in a mighty tree flowing through a little graft will not mix, mingle or modify its life.

New carnations are obtained chiefly by crossing. A cross is a sexual fertilization between two members of the same species. Daybreak and Portia are two varieties of the same species. The seed of one of these fecundated with the pollen of the other would germinate and grow, and blow a flower different from either of its parents. This would be a cross; and, by this law, varieties are produced and may be indefinitely continued by cuttings from the plant.

A hybrid is a sexual union between different species.

Dianthus Plumaris (Sweet William), is one species of the genus *Dianthus*; order, *Diggnia*; class, *Decandria*.

Dianthus Semperflorens (common carnation), is a different species. The seed of one of these fecundated by the pollen of the other would produce a hybrid pink, likely to differ from its parents in the ratio they differ from each other.

Crossing in nature is not uncommon. Hybridization is extremely rare. As a rule, in the animal and vegetable kingdoms, hybrids are not fertile with themselves, but will easily breed back into the original types. Nature reluctantly consents to perpetuate a mongrel race, but is circumvented by art, and the desired hybrid is continued by layers, grafts or cuttings.

While crossing is common, hybridization is a difficult experiment. Gaestner, high authority on hybridizing, says: "Out of one thousand carefully conducted experiments, fecundation was accomplished in only 259 cases." Hybridizing or crossing is simply transferring the pollen of one flower to the stigma of another, with cautionary measures taken to secure success. A cool, damp atmosphere is inimicable to fertilization. The operator must prevent the seed bearing mother from being fertilized with its own pollen, and with tactful fingers, and delicate scissors, carefully open the envelopes of the flower, as it is about to bloom, cut away its stamens and apply the pollen, gathered from the anthers of the male parent, on a camel hair brush, softly apply it to the stigma of the mother flower, which then should be enclosed in a gauze sack to prevent access of insects bearing other pollen.

Pollen retains its vitality for a long time after it is removed from the flower; it is asserted, for weeks and months in some species of plants. This is the artificial process for securing varieties, and nature carries out the same method, with the aid of air and bees for brushes, and chance for parents. The chances of obtaining a better variety than is in cultivation is less than one in a thousand. A cross fertilizer may think himself fortunate if he originates one carnation that will hold the boards for a period of ten years against coming rivals.

Mr. Dorner crosses in January and February, sowing the fertilized seed about the first of April in flats, transferring them when rooted to pots, thence to the open ground where some will bloom by August. His first selection is about one hundred of the most promising, out of, say, two thousand plants. These are transferred to the benches. This list is revised as frequently as

merits and demerits are determined, and he is fortunate, if out of the whole batch, he is able to save two of sterling merit.

Peter Fisher says: "November is an ideal month for fertilizing. If crossings are made in this month, the seed can be sown by the first of February and have three months' growth before planting out of doors, where most of them will bloom. I have had plants bloom four and a half months from the time of sowing the seed. Plants that bloom late have not much commercial value. Plants of strong, fleshy growth are less productive of bloom than plants of a wiry habit and narrow foliage. The pollen should be applied on a bright sunny morning, and if impregnation takes place, the bloom will wilt within twenty-four hours."

Many things are to be considered by the originator of new carnations, as the selection of parents to secure in the progeny, size, form, substance, color, length and strength of stem, none which however, he can count on against chances. Wonderful possibilities lie hidden in the capsule of a cross. The labor of a hybridist is bewitchingly enchanting. He sees in the pollen grain an unleashed spark of vital lightning; in a primal cell of the ovary, a marvelous mixture of sexual forces that may wash new petals with strange colors, toned in the wonderland of life.

Carnations, as with all double flowers, perfect but few seeds. The seed pods contain on an average twenty black seeds, and the time to gather them may be known by the brownish appearance of the seed vessel. Fertilized seeds are worth \$1.00 per hundred, and if sown as soon as gathered, they germinate sooner than when long dried. They may be planted in pots, or flats, and kept moderately warm and moist. Give plenty of air; when the second leaf is formed, transplant into pots, and in time set out in the open ground and treat them as rooted cuttings.

The first show of merit, or demerit in a cross is not permanent: it may marvelously advance or recede in excellence before it reaches the plane of its permanent habits. Mr. Dorner, an eminent cross-fertilizer, says some of his less promising seedlings, in the end, came out on top.

Carnation seedlings have unstable characters. Before they reach the level of their true existence, they vibrate for years be-

tween vital statics of the past and life dynamics of the present, between the force of remote ancestry and the power of proximate parents. Often the oscillating pendulum swinging in a plant of great promise is snared by atavism and tied to a worthless type. Mammoth Pearl was a carnation of unusual expectation, but lapsed into degeneracy; Mars won the Cottage Garden Cup, but its name fell from the roll of merit; Stuart won the Flagon at Indianapolis, but enjoyed only an ephemeral fame; Sea Gull won the Silver Flagon at Madison Square exhibition in 1891, over McGowen, and at once became a pervert, while its vanquished competitor, McGowen, wore the tiara of Whites for years, and still graces ermine laurels. Sea Gull served a purpose, it was the symbol of evolution, the prophecy of possibilities, the herald of a marvelous unfoldment. A life-size cut of Sea Gull, was furnished this work by Mr. E. G. Hill. Possibly more seedlings advance in excellence than degenerate, some of the best varieties coming from seemingly unpromising seedlings. Jubilee was beaten at Indianapolis in 1892 by a scarlet seedling that retired at once from the stage. Flora Hill was outdone by Jack Frost, that lives only in the cemetery of dead carnations.

Introducers should test their new carnations for five years before sending them out, and then accompany each invoice with a statement of their habits and caprices so far as learned.

An account is given in the *Garten Flori* (German), of an artificial cross fertilization between *Dianthus Barbatus* (Sweet William), and *Dianthus Caryophyllus* (Carnation). A few perfect seeds were obtained which grew plants unlike either of their parents. After repeating the operation for six years a plant was obtained with many good habits. It blooms earlier than the common carnation. The experiments prove that it takes at least ten years after being obtained, to fix the type of a hybrid carnation.

There has been an annual average of about thirty new carnations introduced since Mr. Starr originated Lady Emma in 1875. A swelling tide set in, in 1885, when thirty-two were named. In 1886, eight; 1887, thirty-seven; 1888, sixteen; 1889, fifteen; 1890, eight; 1891, seventeen; 1892, thirty-one; 1893, fifty-three; 1894,

fifty-five; 1895, one hundred and twelve; 1896, seventy-two; 1897, sixty; 1898, twenty-five; 1899, forty-five; 1900, forty; 1901, thirty-eight.

The extraordinary increase of new carnations in 1884-5 was due to a large number of named seedlings from California. An insuperable difficulty in determining the year of a carnation's introduction is in the records confounding the year it is named, and often advertised, with the year it is offered for sale or dissemination. The number introduced annually is only proximately correct.

Mr. Witterstatter, a very reliable and laborious cross-fertilizer says that most of the carnations he has exhibited and put on the market were accidents and surprises, on the crosses he made. He has kept a record of 2700 cross-fertilized seedlings; he is modest enough to admit he never was behind life's curtain, and knows nothing of the play of her secret unseen vital forces, but thinks the pollen parent most likely to influence color and the mother parent the vigor of the product. Beyond this he knows nothing of the mysterious alchemy of heredity.

Mr. Dorner, also an eminent cross-fertilizer, says that if there is any rule in cross-fertilization that he has learned, it is that the lack in one parent should be supplied by the other; that color cannot be depended upon at all; that two crimsons may beget a white.

Mr. Bissold, a practical cross-fertilizer, says that a man may use a thousand seedlings and not get the same shade of colors as the ones he uses. He never could obtain a yellow or dark pink.

The late Charles Starr was the pioneer cross-fertilizer and rocked the cradle of new carnations in America. He introduced them to public favor, and originated fifty new varieties in which yellow and variegated colors predominated.

Mr. Fisher says further that he has raised strong growing plants, evidently a new botanical creation, that would not yield more than eight flowers the whole season. Varieties with wiry stems and narrow foliage are invariably free bloomers. He thinks flowers three and four inches in diameter can be reached on plants with these primitive habits and of great florescence.

Nature's laws of proportion are not guided by the optimistic prophecies of cross-fertilizers. Four-inch flowers are reached, but not on woody plants with narrow foliage and procumbent habit, but on plants with broad fleshy leaves, great stems, monstrous nodes and fibrous roots feeding on gross humus, flourishing in great heat, and circulating an immense volume of vegetable blood.

Variation is a basic law of nature, the primal source of varieties, and the foundation of the cross-fertilizer's art. Some species of plants possess the varietal tendency stronger than others. Self-pollenization is no security against plant diversity. Mr. H. Vetch asserts that wheat is self-fertilizing, that the pollenization is effected in the bud and fecundation is impossible from foreign sources, yet new varieties of wheat are constantly occurring in a field, where all plants are surrounded with precisely the same conditions.

The grosser structures of a new carnation are more easily secured by the selection of male and female parents, than are color and fragrance. Mr. Chas. T. Starr, obtained Buttercup, Duke of Orange, Lady Chatting, Venus and Field of Gold, from a batch of seeds crossed by Edwardsii, La Puritie and Astoria. It is a singular fact that most of Mr. Starr's fifty fine introductions belong to the variegated class of colors, while other fertilizers have been most successful with solid strains of colors. A new carnation, be it an artificial cross or self-fertilized, cannot possess precisely the same nature as either of its parents. There is a co-mingling of sexual cells in the crypt of conception, to start a new life, which is the unified product of the vital essence of different parents, which must give it an idiosyncrasy distinctively its own. The carnation belongs to a class of plants that matures the pollen before the pistil is ready to receive it. Nature revolts at self-fertilization, and this provision in plants is a protest against inbreeding. It gives time for the flowers to be fecundated by foreign pollen, and only in default of this fact does it accept its own pollen. This interval between the maturity of the pollen and pistil of the same flower wonderfully favors the operations of artificial cross-fertilization.

Mr. Thorp who disseminated many new varieties, says that inbreeding with a batch of common blood seedlings is the quickest and surest way to obtain a definite and an individualized plant and flower.

Mr. Swayne, who has originated some good carnations, says that vigor in a plant is obtained by using pollen from single flowers and that such pollen will beget as many double flowering seedlings as will pollen from the stamens of a double flower.

The North Dakota agricultural station alleges that an excess of food to plants is the cause of varieties. Food has no more to do with the origin of varieties than maze fed to a mare has in begetting a mule. Varieties spring from opposite sexual forces meeting and mingling in a conceptive cell.

A thousand carnation seeds will scarcely produce two alike. They will be single and double, erect and sprawling, monstrosities and models, strong and weak, late and early, perverts and paragons, with colors and shades that shame the chromatic scale. But this is not strange, since nature never obliterates progress once made, but embalms vestiges of it in all succeeding structures, atrophies and carries them forever to the front. If man could rightly read the hieroglyphs nature etches on her creations he would find the data of an unfolding history in everything from a worm to a world. Man carries in his mind and body vestigial relics, habits and homologues of every plane of organization and civilization through which he has ascended since Adam bit the apple.

The majestic harvester that kings the fields of golden grain embodies all the mechanical appliances that have evolved for gathering grain since Ruth gleaned the fields of Boaz. The ponderous locomotive that has continents for race courses, with oceans for boundaries, is an epitome of all the practical devices of applying steam as a motive power, since Watt saw the imprisoned demon lift the lid of the boiling kettle. It is to these retained, conflicting hereditary forces that carnations owe their erratic, versatile and capricious nature. Vital vestiges and ancestral forces of all the species from which it sprang are hidden as latent relics, in

a carnation germ, ready to fresco their features on every new carnation's life, since astonished Theophrastus exclaimed *Dio Anthos*.

New species are permanently established in opposition to the tireless tendency of plants to lapse to their primitive types. The principle on which it is done is fully explained in a quotation from Asa Gray.

"When an offspring inherits the peculiarities of its immediate parents, *its* offspring has a redoubled tendency to do the same and the next generation still more; the tendency to be like the parent, grand parent and great grand parent, conspires to overpower the influence of a remoter ancestry."

A species is initiated by a variety, but its fixity is the culmination of conspiring generations. La Puritie, the stable type of the remontant species of carnations, was the product of a dozen cross-fertilizing conspirators from 1844 to 1856. The new species, *Dianthus Superba*, with grosser structure, stiffer stems, larger flowers, requiring more heat, greater moisture and different nutrients, is the culmination of a hundred cross-fertilizing conspirators during forty years to evolve a species of carnation to meet their higher ideals.

Mr Peter Fisher thinks it possible to obtain a strain of carnations that will come true from seed. This may happen when nature reverses its law of diversification and starts unifying the vegetable kingdom.

It is natural for originators to make pets of their seedlings, maximize their merits and minimize their faults. They boom them into notoriety by seductive advertising, the sorcery of half-tone engravings, and, possibly, some financial plunger, who does not know a corolla from a calyx, will offer a mythical sum of money for a new variety, and confer upon it the name of his wife for its stunning effect on the trade.

There are on an average twenty new carnations introduced every year; the originators are chargeable with a knowledge of their merits by the venesected purchasers of stock from the time they hold a proprietary interest in the new creation, and have

some rights in an adjective name. The trade should prefix the originator's name to every new carnation purchased, as, Dillon's Queen Louise, Ward's Roosevelt, Dailedouze's Prosperity, Weber's Norway, Fisher's Lawson, Witterstatter's Estelle, etc. It would make men who put new carnations on the market more cautious about their intrinsic merits, to know their names were to be prominently associated with their failure or success. It would be an assurance to the trade, and start a new roster of more rythmical names for carnations. To the originators, at first, it might appear critically bold, but they should not be super-sensitive, when they now walk without emotion through the necropolis of history and see their perfunctory certificates of character in brackets decorating the graves of from five to fifty of their own defunct carnations.

I would put the carnation's name in parentheses and the originator's name in base relief to show that they accomplished much or little.

A great fertilizer merits a fame fit to sit beside Alegatiere's. An adventurer riots on the money of his victims.

It is amusing to hear some cross-fertilizers expatiate on how they led "Dame Nature" through the avenues of ancestral life and corraled her as a paragon of merit. History says that King Canute threw away his sceptre, abandoned his throne and hung his crown on the brow of a sculptured Christ, but there is no instance on record of nature surrendering her empire, and handing her sceptre over to a pollen monger. Cross-fertilizers have by accident accomplished much, but they are as ignorant of the play of hereditary and vital forces as they are of their own destiny. A fertilizer thinks he has imprisoned in some seed pods parental force that will write his name beside Alegatiere's; he sows, grows and flowers his thousand prize seeds. Fifty per cent of the batch have lapsed to the single type that grew on the shores of the Mediterranean two thousand years ago; some look a little like the male parent, others like the mother plant, and the rest like neither; but, like the hardy garden pink, some are freaks like a "double headed calf," "bearded woman" and "a what is it."

After the lapses, decaðents, perverts, derelicts, nondescripts, monstrosities and degenerates have been eliminated there may remain half a dozen creditable flowering plants, few of them as good, possibly one or two better, than existing kinds. The humble cross-fertilizer is as likely to obtain a grand carnation as those professional seedling raisers, who read learned and romantic disquisitions before societies on how their marvelous wisdom inveigled nature to serve their ideal purposes. There are very few originators of new carnations, but conscientiously believe their products are meritorious. The great dangers lies in over faith in their excellence.

There is no possible way of determining the sterling commercial value of a carnation, but by general trial in different sections of the carnation belt. The storm center of interest and enthusiasm in carnation culture is wrapped up in new carnations, in their adaptability to localities and in their hidden possibilities they enfold, ardor, zeal, hopes, aspirations and poetry. Strike new carnations from the contingent of a grower's labor and it degenerates into dull routine and spiritless prose. Then, the few seeds from a single pod may contain the germ of a world winner. Henzie's White, the most robust and defiant carnation in the roster of the royal line, was in a pod incidentally plucked from a plant that had stood out all winter in the latitude of Detroit. Seeds in the same carnation capsule produce plants as divergent as seeds from different ones. It is estimated that not more than one carnation seedling in a thousand is honored by the growers of new varieties even with a name. About twenty-five new carnations are introduced annually, and not more than one of these takes rank as a general favorite, like McGowen, Portia, Day-break, Scott, etc; so every first class commercial carnation is finally the selection of forty thousand seedlings.

CHAPTER V.

LIFE LIVES IN CELLS—CONTINUING LIFE BY CUTTINGS—THE CONDITIONS REQUIRED—DIFFERENCE BETWEEN A CUTTING AND A SEEDLING—KIND OF CUTTINGS— TIME TO STRIKE THEM.

A CELL is the unit of life. In a seed it lives in a single cell, with power to live and add to itself new cells. A polypus cut into a hundred parts, each piece will grow a perfect polypus. An expert English propagator recently died in Chicago whose keen preception of required conditions, it is said, enabled him to root cuttings from any hard wood plant or tree that grows. In a cutting, life exists in many cells already formed with power to multiply themselves. A slip severed from a parent plant faces death which only human sagacity prevents; experience has demonstrated that if it is placed in pure sand with proper moisture, heat, light and air, it will develop roots and perpetuate itself.

The law of life, as announced by the venerable Thomas Meehan, has been vindicated by twenty years of observation, viz: "Nature in the vegetable kingdom always makes an effort to continue life in the ratio of its danger of death." Extinction, or persistence, confronts cell life in a cutting, and it struggles for continuance. The features, habits and all the qualities of a seedling carnation are fixed the moment ancestral life-forces meet, mix and mingle in a primal cell, in the ovarian crypt. That method of treating carnation cuttings and plants is the best which is closest along the line of character nature has impressed on the species.

Henzie's carnation, the Napoleon of American whites, originated in Detroit. It was the seedling of a plant that had remained out unprotected the previous winter, and the parent of millions of cuttings before it met its Waterloo against the resistless legions of better kinds.

In cross-fertilization there is union by fission in the germ cell of two varieties, and a different entity of life is established. There is no difference between self-fertilization, and propagating by cuttings; they both have the same plasm and spring from the same primordial cell, except homogeneity which is lost by the union of diverse sexual forces. Propagating by cuttings is not devitalizing; production by seed is rejuvenating.

The lack of knowledge of a carnation's nature has sent many good varieties early to the necropolis of extinct kinds. Buttercup was obtained by Chas. Starr from La Puritie, fertilized with the pollen of Astoria. The first carnation born in America by artificial cross-fertilization is still cultivated.

Dailedouze, Ward, Weber, and others say they now succeed fairly with Buttercup when grown through the summer under glass. If summer glass meets the erratic wants of capricious Buttercup, it will have found De Soto's fountain of perpetual youth, and its bewitching wealth of colors will perpetuate the name of Starr longer than the marble slab above his grave at Avondale.

The vigor of a variety can be maintained indefinitely by careful culture, but new kinds will relegate them in the race of evolution.

CUTTINGS.

Successful carnation growing starts with the proper selection and treatment of cuttings. To secure vigor and avoid deterioration of plants and flowers, it is of the very first importance to begin with an absolutely healthy cutting. There is some difference of opinion among growers as to the part of the plant from which cuttings should be taken. In a cutting is hidden the life forces of its parent plant, its merits and demerits, its weakness and its vigor; life in a cutting can raise no higher than its fountain, but may grade down, and emphasize its parents defects at the time it was taken from the parent stem. In this lies all there is in carnations running out. The only question to consider is the health of the crop, and not the dogma of any grower. Cuttings should be taken from stock that has not been over forced, or fertilized. Cuttings four inches long taken as side shoots from flowering canes make good

cuttings and are at the same time a species of pruning and disbudding for crown flowers. Cuttings taken near the top of the plant contain in them more advanced flower germs than those secured at the base of the plant, and are more likely to bloom earlier. Aside from this fact it is immaterial from what part of the plant the cuttings are taken. The upper parts of plants have better light and ventilation and therefore are healthier than shoots around their base. No cuttings showing signs of shooting a bud should be used. The cutting crop is usually considered secondary to the crop of bloom. Early struck cuttings should be carried from two into four-inch pots if necessary.

The period of striking carnation cuttings is from August to April. Plants of later varieties, and those designed for early inside, or out-of-door blooming, should be struck in the early part of this period. A rooted cutting advances a carnation's life ninety days over one germinated from a seed.

HANDLING YOUNG CARNATION PLANTS.



Figure 1.—Wrong position for a cutting in the sand,



Figure 2.—The proper position.

The propagating bench should be thoroughly cleansed, and a thin wash of lime spread over the bottom and sides, then filled with four inches of washed sand, absolutely free from all impurities, smoothed down; and incisions three inches apart should be made in the bed with a trowel, guided by a lath. In these incisions, the cuttings are deftly and vertically set, two inches deep and a half inch apart, the sand firmed with the point of the trowel along each line of cuttings and then thoroughly wet with a fine rose nozzle.

Carnation cuttings in the sand should be moistened daily, have good ventilation, and be screened from the sun by a curtain of muslin, and not by laying paper or anything else over the top of the cuttings. In the proper temperature, the severed ends of the cuttings will at once begin to callous, or cover themselves with a root epidermis from which cell growth will rapidly elongate itself into roots. Cuttings will root in from two to four weeks. The variation of time rests with the varieties, and in the degree of top and bottom heat used. Ninety-five per cent of some varieties will root while of other kinds only about fifty per cent.

Small growers often use flats filled with sand in the absence of a formal propagating bench.

Before the cuttings are excessively rooted they should be carefully lifted and transferred to pots, or flats, in moderately enriched sandy soil and kept in a temperature for a time but slightly lower than that of the bench from which they were removed, carried thriftily forward, and gradually hardened off for field culture.

Care should be taken in transferring plants from the sand to pots, or flats, that their fragile rootlets are not broken, as it takes time to repair the damage and works in the flats for them a renewal of cutting bench methods.

At first, two and a half-inch rose pots are preferred. They increase labor and care over flats, but are transplanted with less injury to the plants in the open ground. Flats, if used, should be two feet square, three inches deep, with four auger holes in the

bottom for drainage. The rooted cuttings should be planted in the flats in exact rows, two and a half inches apart, each way, and the soil moderately firmed between them. The flats should be transferred to the field. With a sharp case knife, cut equal distance each way, between the rows of plants, to the bottom of the flat, and if properly rooted, each plant will lift out with a ball of earth adhering to its roots.

Some successful growers, as a precautionary measure against "Rust," immerse their cuttings both before they are inserted in and after they are taken from the sand in a fungicide solution; care being taken not to involve the severed ends, or rootlets in the mixture.

An effective formula for such a wash consists of

Potash.....	1 lb.
Fish Oil.....	3 pts.
Water.....	2 gals.

Prof. Baily has experimented with a number of cuttings taken from three different parts of a plant as follows:—

1st.—Bottom shoots make vigorous plants with broader leaves, stockier stems than any others, and are fuller of bud germs, but bloom later.

2nd.—Lateral shoots from stems are less robust, have narrow leaves, but bloom as freely as the first kind.

3d.—Cuttings taken from the base of plants are weak, poor, and without much bloom or promise.

There are carnation plants lifted late preternaturally robust and strong, with leaves and stems that are diseased. Their vegetative vigor has partially extinguished their reproductive forces. A fat cow gives but little milk. Nature is frugal: when it lavishes in one direction it economizes in another. If undue vital forces of a carnation plant are expended on the leaves and stems, it saves up on petals and stamens, which are but modified leaves. The equilibration of their vegetative and reproductive forces is destroyed, and petals are aborted in the interest of leaves, and flowers in favor of foliage. In high grade flowers on diminutive plants, under summer glass, these functions of plant life are just reversed.

Cuttings taken from either class of such plants will perpetuate, for a time, these features of their parents, being comparatively barren or tentatively fruitful of flowers.

Propagating by cuttings is not an unnatural process for continuing species. Nature adopts it in the segmentary process of many plants, and by the agamic process in the lower orders of the zoophyte kingdom. The greenfly largely perpetuates itself by nodules that develop themselves on the inside of the walls of their abdomen, from which they separate, and are born living insects.

TEMPERATURE.

The temperature employed in striking cuttings is a matter on which growers do not fully agree, but it can be largely settled by the laws of vegetable physiology. It is presumption for any one man to say this is the proper temperature, or that is the better cutting, if it is not along the lines of plant life. The temperature for the cutting bench should, for a few days, be no higher than that in which the plants were kept, from which the cuttings were taken.

The heat used for rooting varies with different propagators. Some use no bottom heat, maintaining merely the common greenhouse temperature of 65 to 70 degrees; others use bottom heat, the sand being 10 degrees above the house heat. The ideal temperature for rooting cuttings is 60 degrees for the sand and 40 degrees for the house.

CHAPTER VI.

CARNATIONS IN THE FIELD—PREPARATIONS FOR THEIR FIELD LIFE—THE SANITARIUM FOR CARNATIONS—PRECAUTIONS AGAINST FAILURE—NUMBER OF PLANTS GROWN TO AN ACRE.

THERE has been a profusion of literature about the soil suited to the carnation plant. With data gathered through years and as comprehensive as the carnation field of America, the author is not disposed to attach to the soil the importance that has been given to it. Soil is the most tangible thing an observer sees to ascribe success, or failure with carnations, which is the source of its prominence.

It is an unquestioned fact that carnations reach high development in sandy loam, limestone, argillaceous and micaceous soils. The Massachusetts experimental station has grown superior carnations in coal ashes and peat. Every carnation grower has his preferred soil, and it is always the kind in which he has made a success in growing them. My ideal carnation field would be a sandy loam with an adhesive element of clay, with a northern inclination.

There are but few points on which American carnation growers are a unit. One is that the plants should be set in the field for summer growth as soon as the condition of the ground and weather in the spring will permit.

The open field is the sanitarium of carnation plants. It brings them for a time in close touch with the great healthy heart of nature where they receive a fresh baptism in the eternal flame of life. Mythology says that Antæus received new strength every time he kissed his mother earth. In the ratio of distance, in treatment or geography, plants are removed from their normal conditions and natural habit, they sport. Their natures become infertile and they refuse to continue their species; the carnation is largely seedless as most all double flowers are.

The carnation plat, if it does not possess a gravelly or sandy sub-soil, must be well underdrained, given a coat of well rotted manure, and, as a precaution against stem-rot, a light spread of lime or wood ashes. The ground should be deeply plowed, thoroughly pulverized, evenly rolled and accurately marked out, ten inches each way for a hand cultivator, and ten inches by three feet for horse cultivator, cavities being made at the cross sections of the markings with a half-round trowel in which the roots are inserted, the dirt pulled around them and made firm with the fingers. If the field is of doubtful sub-drainage, planting the carnations on slightly elevated ridges may fortify the crop of plants against great damage from excess of wet. The time for transplanting carnations in the field in the carnation zone ranges from the 10th of April to the 10th of May. Frost or a moderate freeze will not injure the plants if they are properly "hardened off", which can not be determined by the appearance of the plants, but by the treatment they have received in their transition from greenhouse heat to outside temperature. The hardiest plants may be killed in being transferred at once from under greenhouse glass to the open ground. The average of a carnation's life in the field is four months; during this time the ground should be frequently superficially stirred. The hand cultivator is altogether the preferable implement, but when the acreage is large it is laborious. The accepted and rational principle applied to crops in agriculture, as to rotation, applies with equal force to carnations, not however on the ground of food elements in the soil being exhausted by the crop, but on the theory that every species of vegetation grown long on one spot attracts hordes of its own particular insectivorous and bacterial enemies to the place as a base of supply and breeding grounds.

The "greenfly," "thrips," "root nematoides," wet and dry "stem rot," are caused by insectivorous and bacterial germs, that especially find congenial food in the *Dianthus* genus of plants. Changing the location of carnation fields must disarrange their multiplication. The *Dianthus* family of plants are hardy in the temperate zone. Adaptation by selection is breeding carnations

from their ancestral nature, but many parental vestiges will never be eliminated from them. A black colored soil will maintain six to eight degrees higher surface summer heat than a light colored soil. Observing growers have noticed that vegetative processes are as completely arrested in carnation plants during extreme periods of summer heat as if the thermometer indicated 32 degrees. For this reason a northern inclination of a carnation field is to be preferred and is a concession to the low temperature relic that still lingers in carnations.

Carnations in the field are subject to all the troubles that assail them on the benches, but the vigor of life from normal conditions, forms a greater resistance to their depredations than the artificial restraints of housed plants. The fungus of "root rot" is the most destructive enemy of carnations in the field. There are records of a large per cent of the crop of plants being ruined by this parasite. (See chapter on fungous diseases of carnations). When it is deemed necessary to use liquid fungicides, insecticides, or fertilizers on carnations in the field, the rows of plants can be straddled by a hand cart, holding a vessel containing the material, and with a good spray pump, quite a broad span of the plants can be reached. In carnation fields of large area, an eight foot roadway is left unplanted at convenient widths for a horse and cart hauling a barrel, for watering or treating the plants medicinally. It should not be forgotten that stirring the soil is a partial antidote for drouth in all soils sufficiently compact to admit of the capillary attraction of sub-surface moisture.

The number of carnation plants that can be grown on an acre, set fifteen inches apart each way, for hand culture, is nearly 28,000. If planted six inches apart in the rows, and the rows three feet apart for horse cultivation, about the same number can be grown.

CHAPTER VII.

CARNATIONS FROM THE FIELD TO THE BEDS OR BENCHES— EARLY AND LATE LIFTING—WET AND DRY WEATHER —BENCH PLANTING—WATERING AND SHADING.

THERE has been a revolution in the last few years in regard to the time of housing field carnations. Many are now lifted as early as August. They bloom earlier and find a better market. Mr. Hartshorn, an up-to-date grower, commanding a good market, houses his carnations by the first of July, allowing them only eight or ten weeks of field life and claims he has splendid results. Some growers do not plant in the open ground, but turn their plants out of the pots into bench soil in April and grow them continuously under glass where they commence blooming about the first of October. The advocates of this system and its modifications, assert that they obtain a higher grade of flowers, strike a scarcer market, and realize a better price, which fully compensates for the additional cost and labor the plan involves.

A solution of the rebus for obtaining a supply of carnation flowers from July to November is involved in the unquestioned law of vegetable physiology, viz:

"Each species of plants requires a certain number of units of heat and light to complete its course of vegetation. The mean temperature and sunlight multiplied by the number of days gives the sum of heat and light required for its developement. If the mean temperature and light is lowered, the number of days must be increased; if increased, the number of days must be lowered."

A carnation cutting struck in January, will ordinarily bloom in November. If it was struck two, four, or six months earlier, would it not, according to the quoted law, reach its blooming period correspondingly earlier, abating the loss of heat and light for winter days? I am not aware of well defined experiments

on this line, but it opens up quite a field and may solve the question of growing carnations under glass, early and late lifting, and a constant and uniform succession of carnation flowers.

Carnations are now generally lifted between the first of August and the fifteenth of September. A successful grower thus summarizes his practice: "I strike my cuttings the first of January, plant them out as soon as the weather permits and lift them the first of September. Keep the house at night at a temperature of 50 degrees and day heat at 65 degrees. Fertilize them with old cow manure, mixed with ground bone and air-slacked lime, and I never fail to have a full crop of bloom at Christmas and Easter."

Carnations can be rapidly lifted in the field with a light concave spade and, as raised, grasped by a helper, and without adhering dirt, laid parallel in boxes of convenient size. It requires five men to lift, transfer and bench plants rapidly. It was an early custom to plant in clay soil and lift the plant with a ball of dirt around its roots. Experience has demonstrated that there is no advantage in this mode and it greatly adds to the labor.

An extensive grower says he prefers to lift his carnations in dry weather. To use his own language, "They stand in need of drink, absorb the water given them, wilt and blight less than when transplanted from wet soil." There is a vestige of vegetable biology in this assumption. A plant from a dry soil is not distended with fluids and would apparently, if not really, suffer less wilting on the suspended absorption of fluids by the roots that inevitably follows transplanting. This interrupted absorption is compensated to an extent by shading and a drenching wetting given carnations on their removal to the house. Wet and shade closes the plant's stomata, or the exhaling pores, and arrests the evaporation of its fluids. There is no philosophy that controverts the assumption that plants should be transferred from the field to the benches with as little shock to their vegetable system as is possible.

Excavations are made in the pulverized bench soil to the bottom and the roots of the plants inserted to the depth they grew in the field, the soil being pulled around and firmly pressed

with the fingers. The plants are set eight or ten inches apart each way and two inches from the edge of the bench. Some knowledge of the dwarfer and grosser growing kinds is a factor in the planting distances. Plants should be graded as to the size, and the smaller ones from the field potted to fill vacancies that may occur on the benches, and if carried cold through the winter, will make magnificent blooming pot plants in the spring. No carnation will give satisfaction in less than a six-inch pot. Soil on the benches should be not less than five inches deep and but little richer than that in the field. A rich soil is detrimental to the plants until they are established and begin to feed.

The carnation is a well defined biennial; the leading peculiarity of a biennial is that it lives two years, interrupted midway in its life by the coma of a winter's cold. The forces of its life in these two seasons have entirely a different trend. The first season is devoted exclusively to the vegetative developement of the plant; the second season, its life is given over to reproductive energies, to strenuous efforts to continue its species of which flowers are incident.

All biennials have a vegetative and a reproductive stage of life and a *coma* of life's forces between these stages. They can then be lifted and replanted without the least disturbance of vital activities. When the vegetative stage has culminated, is the time to lift carnations; it may be difficult to determine that stage, but this is the last analysis of the *lifting question*. It is also a solution of why carnations that even approach the torpor stage in biennial life can bear removal, as no annual or perennial will.

Adaptation by selection and greenhouse methods have converted the carnation into an annual with a lengthened season; but its stages of life will ever be marked with puberty and adolescence and maturity, vegetative and reproductive forces, in the biography of its life. Frequently these two vital energies become deranged and abnormally developed. Every grower has met with great, strong, robust carnation plants comparatively sterile of flowers. The *vegetative* energy has extinguished its *reproductive* life, consequently the plant is diseased. In growing carnations

under glass through the summer, the augmented units of sunlight and heat abnormally develops the plant's *reproductive* forces, and the large flowers are the products of a destroyed equilibrium in the plant's natural and healthful momentums.



NORWAY.

This carnation originated with Webber & Son, of Oakland, Md., and first disseminated in 1901.

CHAPTER VIII.

SOLID BEDS—SUB-WATERING BEDS—RAISED BENCHES WITH WOODEN, SLATE AND TILE BOTTOMS—TESTIMONY OF CARNATION GROWERS—SOIL FOR BEDS AND BENCHES.

THERE are but two fundamental principles in the construction of beds or benches for carnations in the house. They involve *sub* and *surface* heat to the roots of the plants. The old style wooden bench is too well known to need a description. It may be constructed chiefly of iron with a slate or tile bottom. Messrs. Bassett and Washburn prefer an elevated bench bottomed with two-inch drain tile, laid close together, and supported by cross timber corresponding to the length of the tile. The Vessy bench has advocates and theoretically possesses some merits. I give the originator's description.

"We raise the surface of the ground twelve to twenty-four inches as desired, and hold it in place on each side of walk with two-inch hemlock, well coated with cement on the inside. This bed is made level and firm. Upon this we lay four-inch common drain tiles as close together as they can be laid. Above this we put hemlock side boards eight inches wide to hold the soil for plants, which is put upon the tiles. The boards above and below are held in position by two by four pieces at the ends of the boards, and are stayed across at intervals of about four feet with strong galvanized wire. This bed affords perfect drainage, a cool, airy bottom, lasts longer and holds a greater weight than do raised benches of wood with tile bottoms."

Beds for carnations can be made directly on the floor of the house. They can be elevated eighteen-inches to two feet on common earth laterally supported by a cemented course of brick or planks, which adds to the convenience of the constant attention they require during their in-door life.

The sub-watering bed is described and illustrated in the chapter under that head. *Solid* beds and *raised* benches are still

in their disputative era. It is possible that the most practical and economical house bed, or bench, for carnations, has not yet been evolved, and habits of varieties may yet determine it.

An experienced grower on both beds and benches writes: "Bradt and Olympia will not do on solid beds. I find no difference between Gomez and Croker on beds or benches. White Cloud has done the best of any of the whites on beds."

Another observing grower, on both beds and benches, says: "I do not get as many flowers off of my carnations in beds as on the benches by ten per cent, but this loss is fully retrieved by less care for the plants and less cost of beds than benches."

A medley of opinions from leading growers as to the relative merits of solid beds and raised benches, for raising carnations, like the following have been received, which shows that the question has not yet crystallized into a uniform or scientific shape. "Carnations are more disposed to burst their calyxes on solid beds." "Carnations grow with great vigor on solid beds but produce less flowers." "I like beds for some varieties and benches for others." "I want no beds." "I would change all my benches to beds if my houses were suited for it." "Beds are better in the summer, and benches in the winter."

There are a few unquestioned facts relative to beds and benches for carnations. Beds are the cheapest in the long run, a more uniform moisture is maintained for the roots; they require less attention to watering, the plants are more robust, and if they produce less early, they yield more flowers later; the crop of bloom cannot be so well forced on beds; though more vigorous they are not as a consequence more florescent. Some varieties of carnations may improve on one or the other of these conditions, but the list is not determined. Benches generally are more elevated, and more convenient for working with the plants; the heating pipes are by the side, or a few inches beneath the bottom of the benches, and the forcing of the susceptible nature of this plant is placed under immediate control. Plants on benches are nearer the glass; the roots subjected, if desired, to more or less heat; restricted as to quantity of earth; all three of these tend to develop the reproductive features of the plants which culminate into flowers.

Beds, benches, growing under glass, and a knowledge of the blooming periods of varieties are the four factors destined to solve the problem of a constant and uniform succession of carnation bloom. God gave the plant. It is for man to evolve the plan. There are enough facts and physiology now possessed to inaugurate it within a year.

SOIL FOR BED AND BENCHES.

The depth of the soil on the benches has passed through its controversial era; it was fought on the extremes of from two and one half to eight inches, and each had advocates; five inches is now accepted as the economic mean. Whatever mode is adopted to sustain the soil, sub-drainage must be perfect, the soil should be compact and not too rich in humus. It is easy to supply fertilizers and difficult to diminish them. Some growers displace all the bench soil every year, and substitute fresh; others remove a part and add a proportional amount of new soil. This practice does not arise from an impoverishment of the bench soil by the crop, but as a matter of precaution against possible bacterial germs in the old soil.

Science has long known and experience has proved that soils contain countless microscopic bacterial organisms. Some classes of these microbes promote vegetative growth by transforming the nitrogen of humus into a condition to be absorbed by the roots, and assimilated by the plant. They are nitrogenizing microbes, and are beneficial to plant life.

There is a different class of germs in all soils that work just opposite results. Their function in life is to dissipate nitrogen and starve the plant. They are de-nitrogenizing microbes. The heat and moisture maintained in greenhouses, makes culture beds for these pernicious soil germs. Experience has proven that safety against them is in the annual substitution of fresh soil. No soil for benches is better than old disintegrated sods from an old pasture, but never taken from near trees, fences or hedges. There the sod or soil is full of microbes, pupas, and puncturing pests. After being transplanted, carnation plants should be shaded from the direct

sun for a week or ten days. A deep shading for the glass, lasting a brief period, is made of lime and water, or yellow clay, thinned with water, strained and applied with a brush or spray pump. A more permanent shading is made of naphtha and white lead, reduced to the appearance and consistency of skimmed milk, applied moderately at first, and deepened as the sun in the spring gains power.

I quote from M. G. Kains, a very intelligent view on shading glass over carnations with preparations of lead and the means to be used in removing the same.

“The removal of white lead from greenhouse roofs is a tedious and more or less difficult job. The florist should welcome any method that will lighten this labor and reduce the risk of the breakage of glass. When this shading is to be applied as a liquid with naphtha, by means of a spray pump, the powdered paint should be purchased; not the paint as it is usually bought in drums or cans. If the latter be used the shade will be much harder to remove in any case, and the method of removing it described below will work much less effectively. The reason for this is that the oil in the mixed paint forms a coating of itself upon the glass, independent of the lead, and is not acted upon by the acetic acid used to remove the lead, only a portion of which can be reached. If adulterated white lead be used the recipe will be useless, because the adulterant commonly used in white lead is barium sulphate, a substance not soluble in acetic acid.

When pure lead is used, mix one part of strong vinegar to four of water, or one part of acetic acid to about fifteen of water, and apply with a fine nozzle direct to the roof. If any drips down it may be used over again since it will have been applied too copiously. Some of the white lead will have been dissolved in this drip and it will not be quite so effective a second time. After application, the usual rubbing may commence, when it will be found that the shade will come off much more easily. The reason for this is that the white lead is changed from the basic carbonate to the acetate, which is very soluble in water. Water coupled with friction will, therefore, easily remove it.”

CHAPTER IX.

TYING UP OR SUPPORTING CARNATION FLOWERING STEMS— DISBUDDING CARNATIONS—A CONSERVATION OF VITAL FORCES—A MATTER OF MARKET.

THERE have been as many schemes for supporting carnation canes as patents on washing machines, but few of which have escaped the observation of the writer. The future may evolve a more simple and convenient mode than that of Mr. Dorner's; but in convenience, neatness, and inexpensiveness it has, as yet, not been excelled. This or some other support should be given carnation plants as soon as convenient after they are benched. In the plan above alluded to, the plants are put in the rows alternately, so that they run in diagonal lines across the bed. At the ends of the beds and at intervals of about twelve feet along them a light wooden bar, supported at either side by an upright, crosses the bed about ten inches from the surface. This supports a galvanized wire along each row of plants, the wire being fastened at the ends, while the cross-bars along the bed receive each wire in a little nick which keeps it from slipping. The tying material is cotton string, which is worked across the bed from one side to the other diagonally, making it appear in a series of triangles. The tying is very quickly done by two men, one at either side passing the string across; it is given a loop over at each wire. The great convenience of this system is that while supporting the plant it is not crowded up together, and the string is not in the way when picking flowers. For very tall growers, a second wire may be added above the first.

A crown flower issues from the top of the main stem of a carnation plant. A terminal bud or flower is the leading one from a side shoot of the stem.

Some varieties of carnations are given to blow crown flowers; such kinds need but little attention in the matter of disbudding;

other kinds start profusely axillary stems. The plant is incapable of maturing all the buds that are thus projected into salable flowers. Disbudding is merely a species of pruning, and should be done as soon as the lateral buds begin to develop on the cane. It diverts the flow of the plant's blood from many buds into one or a few, thus increasing the size of the flower, the substance of its petals, the length of the stem, its value in the market, conserves the vigor of the plant, and builds up the florist's reputation for good stock.

The last analysis of a carnation flower with a florist is "How much money is there in it?" He deals in poetry, but his trade is prose. The question with him is whether he can get as much money for one high grade carnation bloom as he can for half a dozen poor ones. Disbudding is a matter of market.

There are always three grades of carnation flowers, poor ones that no one wants, good ones that everybody buys, fine ones that everybody adores and money purchases.

There is not as much waste by the process of disbudding as one might superficially suppose. It wonderfully preserves the vigor of the plant, its capacity for a renewal of stems and flowers, and its vitality is retained to repeat florescence. All vegetable physiologists are aware that the only aim of a plant's life is to perpetuate itself in vital seeds. When this is done its life-mission is ended, the culmination of its vital forces is reached in elaborating protein compounds and crystalizing them into seeds as nutriment for its embryonic progeny. If a carnation plant is early disbudded, this crucial period of its life is partially relieved and its energies prolonged. An initial bud, with all its parts, is yet but imperfectly modified leaves. Experiments have been made as to the probable extent to which the remaining buds and their unfolded petals are benefitted on a healthy plant by judicious disbudding. It will increase the diameter of the crown flower one inch and the terminal flower half an inch,

CHAPTER X.

PROFESSOR ARTHUR ON PLANT RESPIRATION—SURFACE VIEW OF EPIDERMAL CELLS OF A CARNATION LEAF—SEC- TIONAL CUTS THROUGH A CARNATION STOMA— PHYSIOLOGICAL DEMANDS OF CARNATIONS FOR FRESH AIR.

DEFICIENT ventilation has been, and still is one of the great errors in the successful cultivation of carnations. If there is one thing the anatomical organs and a knowledge of their functions teach, it is an unlimited amount of fresh air, a comparatively dry atmosphere for the foliage, and a moderate supply of moisture for their roots. This is the implication of the plant's structure. Its physiology, and forty years of costly experimental processes have proven these postulates true. Some species of plants rely exclusively for their support on elements drawn from the atmosphere. The ancestral forms of *Dianthus* life were, and are, habitats of high, dry and cool latitudes. If heredity is a factor in vegetable life, the foliage of their progeny must love air and their roots have an aversion to an excess of water.

They are most florescent and healthy in the fall and spring months, when the ventilators are open, and fresh air is freest. Cool air is not necessarily pure air, but it is commonly accepted as an equivalent for ventilation. Ventilators should be raised in carnation houses and fire started when the mercury falls below forty degrees outside.

I am pleased to accept Professor Arthur's views on the anatomy and respiratory functions of carnation plants, but entirely dissent from his conclusion that their nature warrants a system of sub-watering as being in harmony with any known law governing this plant's nature.

The breathing pores number thousands on every carnation leaf, and exist on both the upper and lower surface of the leaf, which is not the case in many species of plants. They are simply mouths or nostrils leading down between the cells which make the tissue of the leaf. Through these openings is *exhaled* oxygen gas, and effete poisonous elements in the form of vapor; and they *inhale* carbonic acid gas, and healthy tissue-building material in atmospherical form.

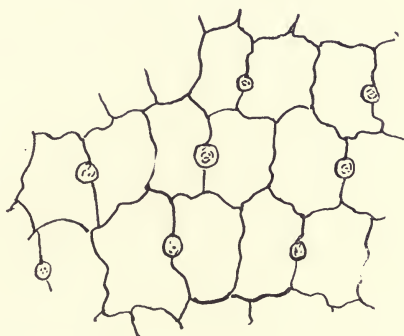


FIG. 1. Surface view of a carnation leaf under very strong magnification, showing the epidermal cells and the round openings leading to the stomata.

A man requires 250 cubic feet of air every hour to supply his system with the needed amount of oxygen, and his blood is distributed over 1400 superficial feet of cell surface in the lungs to absorb from the air inhaled this essential life-giving element.

The vegetable blood of a carnation plant is distributed over an area of cell walls in its foliage a thousand times greater than its leaf surface, for precisely the same purpose as in an animal but with reversed function. The plant expires oxygen and inhales carbonic oxide. An almost air-tight glass house holding thousands of breathing carnation plants would be speedily exhausted of its supply of plant air and they would soon suffocate in their own poisonous exhalations.

This simple automatic arrangement of nature is open only to the entrance and exit of vaporal forms. Leaves do not absorb

water—darkness and water close the valves of these breathing plant's mouths. Careful experiments have determined that one superficial foot of leaf surface exhales one and one-fourth ounces of vapor in twelve hours of sunshine. Light lifts the valves and opens the throttles for plant respiration. Darkness, rain and dew closes the pores and maintains merely and equilibrium of plant

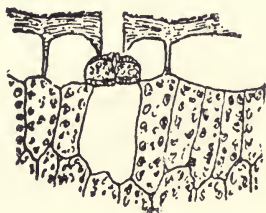


FIG. 2.—Section taken at right angles to the surface through a stoma. The guard-cells, forming the automatic valves, are shown touching each other, so that the stoma passage is closed. The epidermal cells are empty, but the outer wall is excessively thick.

circulation. This is an explanation for not spraying carnations in cloudy weather, in the absence of the drying rays of the sun.

Wilted plants are fresh and full of sap after a night of darkness and dew, because they have absorbed fluids by the root, and exhaled none in the form of vapor by the leaves. They have been breathiess, in a coma, waiting for the sorcery of sun light to stir the magic forces of life into active circulation.

CHAPTER XI.

OVERHEAD WATERING—SURFACE WATERING—SUB-WATERING — CUT OF A CROSS SECTION OF A SUB-WATERING BENCH —RELATIVE COST OF BENCHES AND BEDS— OPINIONS OF THEIR MERITS.

THE amount of moisture a plant requires for its health and development is in ratio to the area of its leaf surface. Nature never makes a mistake in proportioning organs or in the assignment of their functions. It is the function of roots to absorb water from the earth and for the leaves to exhale it in the form of vapor. Leaf surface is an unfailing indication of the volume of liquid vegetable blood required in a plant's circulation. The spacious leafed banana growing in the humid section of the tropics, and the leafless cacti growing in an arid region, are indices of the demands of their structure for moisture, and of the capacity of their roots to absorb it.

Some plants demand more water than others. Water is the means by which floats to every part of the plant the dissolved nutriments to build the skeleton of its structure. An adult sunflower evaporates a quart of water daily; a large oak, one hundred and fifty gallons, or three barrels. These plants have unobstructed capillary tubes, an arterial and venous system through which their watery blood flows in volume. It is estimated that twenty-five pounds of water must circulate through the system of a plant to deposit one ounce of dry matter.

A carnation is neither a sunflower nor an oak. Its circulatory system differs from them. It has no heart to pump the blood through its system, a *vis fronte* and *vis tergo*, is but indifferently developed, and the volume of fluid in its system is small, being one-half less than in aquatic plants. The structure of a carnation like many other plants is composed of cells. The stems and root

were primarily vascular, and converted into hard structures by collapsed cells.

The circulation of a carnation is effected by the transfusion of its blood through the permeable cell walls of its structure, by exosmosis and endosmosis. The process is slow and forbids the assumption that its nature can dispose of much water, and asserts with its small area of leaf surface, that it is on the dry side of the average class of nature's plants.

Forty years of experimental carnation growing in this country has reached one unquestioned conclusion. It is, *moderate moisture for its roots and fairly dry atmosphere for its foliage.*

OVER-HEAD WATERING.

The foliage of healthy carnations is covered with a thin waxy substance called *bloom*. It varies in color from a steel blue to a sea green. It seems to be a shield against moisture, it is impervious and sheds water like the oiled feathers on a duck's back. The purpose of this wet resisting *bloom* is not definitely understood, but it can safely be taken as a warning against an excess of foliage moisture.

The most progressive and successful growers never over-head water their carnations after the flush given them on their removal to the benches from the field. The physiological reason is not very obvious unless it resides in the fact that wet closes the automatic valves of the plant's exhaling organs and for a time arrests the breathing functions of the foliage, and thereby for the nonce gives spores and germs less vital resistance to their depredations. It is a known fact that leaf moisture favors the vegetation of rust spores. When it is deemed necessary to spray carnations with liquid germicides, or insecticides, or with water for other reasons, it should be done on a clear sunny morning, that the foliage may dry as soon as possible.

SURFACE WATERING.

The system of surface watering most approved is between the rows of the benched carnations keeping the nozzle of the hose close to the ground and with a force of water that will splash

the foliage as little as possible. This can best be accomplished by attaching the hose to three feet or less of half-inch metallic pipe. A system that has several reasons to commend, is to make a moderate furrow midway between each carnation row across the bench, and let the water from the hose flow into this furrow. It saves the lower foliage of the plants, which is most likely to be damaged from becoming wet, and takes it the longest to dry.

SUB-WATERING.

Professor Arthur is entitled to the initial credit, if any is due, for the system of sub-watering carnations. As it is difficult to briefly convey an understanding of this mode of supplying water to carnation roots, I give a figure of Arthur's plan.

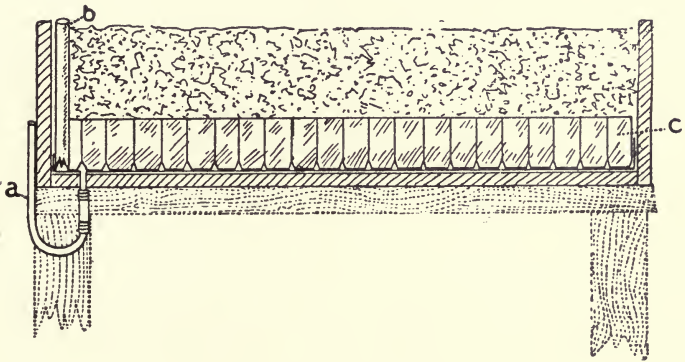


FIG. 3.—Cross-section of bench for sub-watering: *a* glass tube forming a water gauge; *b* vertical tube for conveying water to the pan; *c* layer of brick standing on the zinc-lined bottom, and supporting the soil above. (From Ind. Exper. Sta., Bul. No. 66.)

The bench is fitted with a water-tight lining of zinc, on the bottom of which are placed, on their edges, moderately soft brick with their lower angles chipped off to permit freer movement of the water between them. On the top of these bricks is thrown the bench soil in which the usual methods are followed.

It is known that carnation plants of the La Puritie type are almost an immune against a water famine, and no plants so

quickly recover from a drouth, and with as little damage to themselves as carnations.

The structure of the carnation plant does not teach any necessity for a constant supply of water at its roots, while that of celery does. Benched carnations often suffer from great dryness at the bottom of the bench, but no philosophy can urge an unnatural system of watering to supply the negligence of a grower. There is much care and labor in keeping a proper moisture in a greenhouse through the summer months. By the rapid conversion of moisture into vapor by the summer sun there is an immense volume of latent caloric absorbed; and for growing carnations under glass in summer, Prof. Arthur's system may be a species of automatic refrigeration of the local atmosphere and surface temperature in which the plants may flourish, but the method is totally untenable on the grounds urged by the Professor, viz: "that the nature of carnations require a constant supply of water at the roots."

The proposed sub-watering system created some sensation among growers. I have been diligent in obtaining results from those who have attempted the plan. Mr. Dale says he can see no difference in carnations under the two methods. There is as much danger in *over* watering by the new system as there is in *under* watering by the old method.

Dorner & Son say they cannot observe much difference between the *super* and *sub* system of watering carnations: some varieties it benefits, to others it is detrimental.

J. H. Dillon has compared experimentally the comparative cost of a sub-watering bed and the ordinary wooden bench, and finds the latter, four and one-half feet wide, costs fifteen cents a lineal foot, and a sub-watering bed, thirty cents a lineal foot. The sub-watering system is yet in its experimental stage and it is a question if it ever gets beyond it.

CHAPTER XII.

TOPPING CARNATIONS—SHIPPING FLOWERS AND ROOTED CUTTINGS—ENIGMA OF FLOWERS “GOING TO SLEEP”— OPINIONS OF CARNATION SPECIALISTS— FUNCTION OF PETALS.

CARNATION plants in pots, flats, or fields, should not be permitted to mature flower buds. Most plants that attempt such premature maturity are taken from near the top of the mother plant. All the vital energies of a plant are diverted to the processes of perfecting seed, and, incidentally, flowers. When they bud in a small cutting, those life forces must be arrested and diverted to vegetative growth, and not to reproductive efforts.

In topping carnations, some cut with a knife, others pinch off the tender top, others pull out the center stems. The better mode is to seize the stem with the thumb and finger below the rupture to counter-poise the pulling force. The time to top carnations grown for winter blooming is on the appearance of a flower bud. Some growers remove all incipient buds from mature plants when they are lifted in the field for the benches, claiming with reason, that good flowers can not be obtained from buds started in the field and matured in the house.

CUTTING AND KEEPING CARNATION BLOOMS.

Carnation flowers must open full on the stems and the petals reach a proper stage of maturity, to be lasting when picked. “going to sleep,” or “early wilting” of carnation flowers depends on the hygrometric condition of the plant that produces them, and a corresponding condition of the petals of its flowers. A proper flower from a non-dropsical plant may maintain a presentable condition for three weeks.

Carnation flowers should be cut in the morning and always before fumigation; the stems immersed in small vases filled with water and kept in a cool dry room until ready for market. They should be packed in nice clean boxes, not more than 250 in a mass, and dispatched to reach the commission man early in the day.

An experienced dealer in cut carnation flowers writes: "The temperature in which carnation flowers should be kept after they are cut is 50 degrees, in a dry, clean, well ventilated room. A refrigerator, cooled with ice, is the worst place possible to preserve carnation blooms. The atmosphere is damp and damaging, when they are taken out, their moisture rapidly evaporates and the flowers 'go to sleep.'"

Carnation flowers may be cut too soon, or too late, to keep well. If they are cut after they are fertilized or before their structural cells are developed, they quickly wither. A consensus of the most intelligent opinions and experiences on this important point is, if cut sometime before maturity and allowed to stay in water for several hours before shipping, they will invariably improve and appear to better advantage after the dealer receives them. Keep carnations and all flowers in a large, airy cellar, avoid putting them in an ice-box, and have at all times a good circulation of fresh air; and, above all things, avoid a close, stuffy atmosphere.

Regarding the temperature for keeping carnation flowers after they are cut, experience has been that an average of 50 degrees is the best, in conjunction with a dry, healthy atmosphere, without drafts or currents of air directly on the flowers. A moderate amount of light without direct rays of the sun is essential to their good keeping qualities. A thing to avoid, more especially, is ice in any form. Gas, either illuminating, or from a furnace, and sulphuric from heating pipes, are all poisonous to carnation blooms.

ROOTED CUTTINGS—PACKING AND SHIPPING.

Few have a conception of the enormous traffic there is in rooted carnation cuttings. The desire of every grower to secure

the best kinds, and those adapted to his soil and local conditions, makes a continual demand for new varieties, and an exchange of standard sorts. Cuttings should be carefully lifted from the sand, flats, or turned out of pots, and massed in bunches of 25 each, the roots wrapped in moist moss, *truthfully* labeled, packed in a clean box corresponding in size to the number of plants to be shipped. Line the box with felt paper, in both warm and cold weather, tack the customary label for plants or cut flowers bearing the traditionary legend of "Plants, keep from heat or cold," and start them on their mission.

Healthy plants are always implied. Send such, true to name, or none. After long and multifarious dealings with the floral profession, I assert that there is no class of business men more honest and honorable than florists, but it would be miraculous if an occasional mercenary degenerate was not found among them. Out of 15 or 20 orders for new kinds of carnations sent from near home this spring, one was received consumed with rust. It is hard to conceive of more contemptible moral obliquity. On the affidavits of two disinterested florists to the fact, and publication in trade journals, the offender should be quarantined from business relations with fair dealing men, until his nature has been recomposed by some reformatory machine, none of which has yet been patented.

Scientists have ceased their search for life, and they confine themselves to studying its normal and abnormal phenomena. In all the practical phases of the carnation's life there is not one more profoundly secret, and vaguely nebulous, than the life-related causes of the *transient* and *keeping* qualities of its flowers. Their duration ranges from a few hours to 30 days, when environed with condition, not noticeably different.

Messrs. Dorner and Crabb think the substance of petals and their duration are co-related; Mr. Witterstaetter adds proper handling as a panacea; Mr. Kasting says their keeping depends on the time the flowers are picked after they are blown; Mr. Bauer says a flower on a stem cut from the plant with a sharp knife will last twice as long as one pinched or broken off; Mr. May says he

never saw a carnation flower fumigated the night before it was cut, ship or keep well; Rob't Craig thinks "substance" of the petal a hard thing to define, and flowers that possessed the alleged "substance" to his knowledge have quickly "gone to sleep;" Mr. Hill thought some ingredient is lacking in the soil when flowers fade quickly; Mr. Kasting says he has had much experience in handling carnation flowers and if they are cut at the proper time, and kept in the proper temperature, there would be no trouble about them "going to sleep;" Mr. Herr thought there was as much art in picking carnation flowers as there was in growing them; Mr. Baur objects to the word "*picking*" instead of cutting; Mr. Murchie thinks pollenization is a large factor in the early wilting of carnation's blooms; Mr. Crabb thinks sulphur and other chemicals put in bundles of tobacco stems to preserve them, when burned in the house, had much to do with the flowers withering; Mr. Ward was disposed to blame the express companies; Mr. Fisher said the "Adams Express Co. controlled New England territory."

The above is an abridged interchanging of views that took place between these eminent carnation savants at Buffalo. There is a sub-vestige of philosophy in all the suggestions excepting the one of "Adams Express Co. controlling the territory of New England."

There are no caprices in nature. Things are called versatile and erratic from ignorance of the line of causes that produced them. There may be a conspiracy of causes in producing a marvel, as in the freakish and fantastical duration of carnation blooms. A flower grown in great heat and moisture would not keep long in reversed conditions. Flowers subject to tobacco fumes long, and strong enough to strangle to death Greenflies, must throw the life of a supersensitive and feebly organized petal into *articulo mortis*. After fertilization, the petals of flowers having served their purpose, immediately wither, and there is a period in a flower's life between a plastic petal and its decay in which its texture is the strongest to endure. A factor controlling the most causes of a carnation flower's duration is ignorance of the phys-

iological fact, that the petals exhale carbonic gas, but not oxygen. Their functions are the reverse of the foliage of the plant. Vital chemistry says, petals inhale and exhale the same elements from the atmosphere as the human lungs.

It is not a strained inference, that a healthful atmosphere for the lungs of a man would be proper for both cut and uncut carnation blooms; in fact experience demonstrates it to be so.



PROSPERITY.

This carnation originated with Dailedouze Bros., Flatbush, N. Y., and was disseminated in 1901.

CHAPTER XIII.

IS PRODUCTIVENESS OF BLOOM DIMINISHING?—IS QUANTITY
BEING SACRIFICED FOR QUALITY?—BLOOMS PER PLANT
—SOME RECORDS QUOTED—COMPARISONS.

THE data to reach a conclusion as to the diminishing productiveness of bloom on later introduced varieties of carnations is such as to justify only a very general conclusion. The number of flowers a carnation plant will produce through the season is an interesting enquiry, as well as the basis of a computation of profit or loss in its cultivation.

This information requires time and labor to secure. Some growers have kept tab on the number of flowers they have obtained for a month or two, or part of the season, which is not available data for a generalization. In 1890, Mr. R. W. Winterstaetter, a reliable and painstaking carnation grower, gave exact figures of the number of flowers and cuttings taken from four standard varieties of carnations grown at that date by him, reaching from October 17 to June 27, embracing their entire blooming life, which was published in an earlier edition of *AMERICAN CARNATION CULTURE*.

No. Plants.	Kind.	Flowers Cut.	Cuttings.	Average.
550	William Swayne.	15447	2300	28
332	Silver Spray.	8456	2200	26
550	Buttercup.	11909	4300	22
600	Tidal Wave.	12897	3150	21
2032		48709	11950	22

The general average of flowers per plant is twenty-four. It is conservatively estimated that every cutting sacrifices one flower; if it was so counted, it would raise the general average of flowers for each plant to thirty.

The Chicago Carnation Co., as published in a trade journal recently, has carefully counted the flowers cut from eight standard varieties of carnations grown in 1900, ten years later than Mr. Winterstaetter's figures. The company makes no mention of any cuttings being taken. The report runs from October 8 to June 1, embracing the whole flowering season of the plants, of the following varieties:

No Plants.	Name of Plants.	No. of Flowers.	Average.
3439	Victor.	77193	21
3355	Gold Nugget.	22902	13
1575	Flora Hill.	27875	17
1859	Evelina.	44512	31
1020	Mrs. Joost.	3876	31
2949	Armazindy.	49000	17
843	Argyle.	12000	14
3876	Jubilee.	48000	13
18916	8 Varieties.	285358	15

The general average of flowers per plant is fifteen. The number of cuttings taken from these plants, if any, should be added to the number of flowers, which would increase the percentage per plant. The Chicago Carnation Co.'s flowers, doubtless, were of a higher grade and were grown on advanced carnation plants, and commanded a higher price than those harvested by Mr. Winterstaetter, ten years previous. The tables enforce the fact that the marvelous florescence of the earlier type of carnations is rapidly vanishing before the tireless strain for a better quality.

That quality of carnation bloom is sacrificing quantity is strikingly emphasized in ten years' time. In the third edition of *AMERICAN CARNATION CULTURE*, R. W. Winterstaetter accurately counted the flower crop for the season on Silver Spray, William Swayne and Tidal Wave, three standard varieties, and they averaged respectively, thirty-one blooms and five cuttings per plant, twenty-six blooms and seven cuttings per plant, twenty-seven blooms and seven cuttings per plant.

B. T. Lombard has said he cut from Hector, flowers and cuttings, equaling eighty-four flowers per plant.

W. R. Shelmire has said his flowers and cuttings equaled fifty-four flowers per plant.

W. Nicholson estimated eighty-three flowers per plant.

J. C. Hoag, eighty blooms per plant.

Joseph Renard, fifty-five flowers per plant for half the season.

H. E. Chitty, fifty-six flowers per plant, not estimating cuttings.

DeWitt Bros., five flowers per plant for one month.

B. W. Orr said: "I have just counted (Feb. 10, 1890) seventy-five buds and blooms on one plant of Tenderess. Last winter, one plant had on it at the same time, one hundred and twenty-five buds and blooms."

E. Swayne said: "I cut one hundred and ninety flowers from Aurora during the season of 1890-91."

The evidences may not be very pointed and conclusive that the florescence of carnations is diminishing, the strong inference of the fact rests in the known natural law that the increased size of flower will decrease the number of blooms.

The size of carnation flowers has been increased in diameter in the last twenty-five years from two to four inches.

CHAPTER XIV.

CLASSIFICATION OF CARNATIONS BASED ON COLORS—RATIO OF CARNATION COLORS—EUROPEAN NOMENCLATURE— COLORS A CHEMICO-VITAL PROCESS SENTIMENT OF COLORS.

ASIDE from the prismatic colors, violet, indigo, blue, green, orange, yellow and red, and a few common well understood shades, all is chaos in the science of chromatics. The method of conveying information of a color to a second person is to compare it with the color of some object with which he is supposed to be familiar. There are seventy-five different substances enumerated to illustrate as many shades of yellow, as orange, saffron, chrome, lemon, etc. Carnation means flesh colored. The color of the flower when it was thus christened was doubtless pink and suggested the name; the compass of the term ranges in Caucasian flesh from a pallid white to deep crimson. The term by usage has become generic, and implies flower, plant and species.

The seven primary colors are resolvable into yellow, red and blue. All other shades arise from the interterminal ratio of admixing these colors. Black is the negation of all color, and white a compound of all the primary colors.

Twenty-six letters form more than two hundred and fifty thousand words; seven primary perfumes all the fragrances of earth; red, yellow and blue are the basic pigments of the planet, the color mordants of the world; with these Nature decorates the hills and dales of earth, springs a seven-hued arch across the sky, halos dawns with the tints of morning, and sunsets with the dyes of approaching night.

The classification of carnations founded on the color of their flowers was given to the public by the author in the first edition of *AMERICAN CARNATION CULTURE*, and has been accepted by

florists and the public as concise and descriptive. The system arranged the colors of all carnation flowers into seven classes, which are white, scarlet, crimson, pink, yellow, yellow-variegated and white-variegated. Nineteen-twentieths of all the leading colors pass naturally under these seven classified heads.

A *shaded* carnation is one of these leading colors toned or modified by another.

A *flaked* carnation has irregular blotches of a different color impressed on one of the above colors.

A *penciled* carnation has straight parallel lines of different lengths impressed on the petals bearing a predominance of one of the above colors.

I have never seen a carnation flower with diversified colors but they were impressed upon a ground color in which white or yellow largely predominated, these being the base on which all variegations are painted.

Buttercup is a typical yellow-variegated carnation. It has vermilion pencilings on a yellow ground. Chester Pride is a fine sample of a white-variegated carnation with carmine stripes on a pure white ground. Pink, scarlet and crimson are intensified shades of the same color. The white class ranges from absolute purity to a tinge of cream or pink. The yellow from deep orange to light lemon. The pink from a cherry red to the slightest blush.

The demand for white carnation flowers equals those of all other colors. In hardy pinks, the variegations are always across the petals; in carnations they are parallel with the axis. The yellow colored carnations are the slowest to develop into a satisfactory class. They are more capricious, or susceptible to uncongenial conditions than the other colors. It can be said there is not a satisfactory yellow in cultivation. Many growers use a yellow-variegated kind as a substitute for a pure yellow.

The American system of color nomenclature is preferable to the one in Europe, which divides the strains of colors into bizzars, selfs, fancies and flakes.

The cause of diversity of colors in carnation flowers can never be scientifically demonstrated. Selection of color in parents,

in cross-fertilization revolts at man's knowledge of hereditary forces. Atavism is a scientific fact. Parentalism leaps generations, and then renews its features with enforced effect. There are lapses into barbarism in men wearing stripes in penitentiaries whose ancestors wore the solid colors of civilization.

Some delicate and interesting experiments have recently been made in Germany to determine what color in flowers is. It is found to be a substance called *Flowerblue*, mixed with a red colored element, and pervades the juices of the plant. When the *Flowerblue* is treated with chemicals, various hues are artificially obtained. Copperas turns white hydrangias to pink, roses to a lilac hue; and muriatic acid turns pink carnations to a copper red. The color of the yellow carnation is found to depend on yellow iridescent granules inside of transparent cell walls, and differs in this respect from the causes of colors in other flowers.

To describe a carnation as merely *variegated*, as is often done, leaves the mind in mental darkness as to colors; while to use the pre-nomen *white-variegated*, or *yellow-variegated* indicates the dominating shade and conveys some intelligence.

Repeated experiments have been made to test the comparative keeping qualities of the seven classified carnation colors. They have resulted in awarding the palm, for greatest durability, to the crimson color.

If the German physiologists are right, the yellow colored carnation, with its different habits, marked eccentricities, and means of colorization, it is entitled to rank as a distinct species. It is not colored by the alchemy of its juices, but mechanically, like a diamond that steals a sunbeam and hides it in its heart to sparkle forever from countless facets, the yellow carnation imprisons an iridescent atom in translucent cells to reflect its golden hues.

It can be asserted with scientific assurance, that the coloring of the petals of flowers is a chemico-vital process, in which Nature outrivals Raphael in toning dazzling frescoes. No use is known for petals but that of a gonfalon to guide insects to a bacchanal of nectar. They are painted with pencils made of sunbeams, and pigments mixed with life. The petals are soft, watery and delicately

organized, they exhale carbonic acid gas but not oxygen, they circulate a sap touched with delicate chemicals that by the thaumaturgy of sunlight turns to charming colors, shades, tints and tones.

The green color of the foliage of carnation plants depends upon minute green globules called *chlorophyl* which float in the sap of the epidermal cells. They also rely on sunlight for their emerald hue. A plant grown in the dark is without a green color. Shades of carnation foliage differ in varieties from a steel blue to a glaucous green.

The experimental station of the state of Connecticut has analyzed the petals of carnations and find they are composed of three elements.

Nitrogen.....	33	per cent.
Phosphorus.....	8	" "
Potash.....	59	" "

This fact goes far to show the food on which petals feed.

Carnation is a word of Latin derivation. It comes from *caro*, meaning flesh, or flesh colored. It was first used to indicated the color of the carnation flower, but has become so generalized as to imply a genus of the *Dianthus* tribe of plants, varieties, and any color flower the plant may bear. I have no historical data to indicate the time this term was applied to any branch of the *Dianthus* genus. It is now used to distinguish the perpetual flowering kind from the single crop blooming pinks. Out of thirty-six varieties of the remóntant type introduced this year (1901), the pink color predominates over any other color. Out of nearly one thousand named carnations that have originated, and been imported into the carnation zone of America during the last forty years, so far as history has preserved, their colors have been as follows :

Pink of different shades,	25	per cent.
Scarlet	" "	18 "
Crimson	" "	15 "
White	" "	14 "
Yellow-variegated shades,	15	" "
White	" "	11 "
Yellow	" "	2 "

This does not include twelve varieties of carnations with a greater or less purple tinge to their petals.

The purple class consists of:

Roy des Violet,	Flushing,	Lady Rachel,
Pupura,	Fleta Fay Foster,	Bonibell,
Purple Crown,	Purple Beauty,	Villisco,
Kazer William,	Purple King,	Lowell.

None of these have taken positions of much importance. Four of the twelve were imported.

There has been originated and imported twenty-five solid yellow carnations, running a scale of shades from a pale lemon to deep orange.

Yellow Queen,	Field of Gold,
Yellow Jack,	Cora Collins,
Star Light,	Cloth of Gold,
Old Gold,	Eldorado,
M. E. Gobet,	J. B. Jackner,
Henrietta Sargent,	Pride of Penhurst,
Germania,	Sunshine,
Golden Triumph,	Venus,
Golden Gate,	W. J. Burk,
Gold Coin,	Andalusia,
Gold Nugget,	Ben Halliday,
Eliza Furgurson,	Bouton de' Or.

At least eight of this list were imported. This class of colored carnations is erratic in its habits and does not reach the average in productiveness of bloom, but when it sorts with other colors the product is often robust plants, good bloomers with magnificent yellow-variegated corollas of the Buttercup and Chester Pride types. Carnation plants, as a rule, are the most florescent that blow solid pink, scarlet and white colored flowers. Pure yellow flowers are borne on plants so shy and capricious that many do not attempt their cultivation, but use some yellow-variegated kind to supply this color. The color hues of carnation flowers are

modified by natural and artificial light. The Marquis is more impressive by sunlight, and Croker, by gas light.

A learned professor of an experimental station exploiting plant wisdom formally stated in an address that the first carnations were "*blue*," a most irrational inference in the light of their history. *Past* generations may not have been as wise as plant managers of modern "stations," but they never before have been charged with the solecism of calling black white, or uniformly naming a *pink* object to illustrate a blue color.

A. Linton counted 172 buds and blooms on a California variety named Majesty and thinks a good specimen would yield 500 flowers during a season. A typical plant of such carnations during its blooming period might yield 25,000 petals; more than ten square feet of petaline canvass, every flower leaf textured with tri-strands of nitrogen, phosphorus and potash, twirled in the spinneret of nature wove to fabric in life's subtle loom, moistened with mordants in a calyx-crypt, and juggled into perfumes and witching colors by the magic wand of simple sunbeams.

Nature's sweetest lyric is symbolized by a flower. It is a metaphor in her loftiest poetry, and emblems the divinest emotions that ever thrilled the heart of man. Mythology says carnations sprang from the blood of rival lovers, and typify disdain, but modern romance makes them hieroglyphs of warmer and more generous affections.

Pink carnations indicates Purity.			
White	"	"	Fascination.
Scarlet	"	"	Dignity.
Crimson	"	"	Ardent love.
Yellow	"	"	Refusal.
White-var.	"	"	Friendship.
Yellow	"	"	False.
Red	"	"	Acceptance.



MRS. E. A. NELSON.

This carnation originated in Indianapolis, Ind., with E. A. Nelson. It has been tested for four years, which places it beyond the mutation which often waits on new carnations.

The plant has a strong constitution, is a vigorous grower, and produces its flowers early, profusely and continuously, on strong stems from two to two and one-half feet long. The flower is a beautiful iridescent pink, from $3\frac{1}{2}$ to 4 inches in diameter, and possesses an absolutely unbursting calyx, and has remarkable keeping qualities. It has won records of $91\frac{1}{2}$ to 94 points from critical judges and has been the admiration at every carnation exhibition where shown. It will be on the market in the spring of 1902. The sales represented by E. A. Nelson, Indianapolis, Ind., and S. S. Skidelsky, Philadelphia, Pa.

CHAPTER XV.

GROWING CARNATIONS UNDER GLASS THROUGH THE SUMMER

—WHY HIGHER GRADE FLOWERS—INCREASED COST

—EARLIER MARKET—ADVANCED PRICE

—THE COMPENSATION.

THE system of growing carnations under glass through the summer season is yet in its experimental stage, but is attracting the attention of growers near affluent markets, where quality commands its price. Its advocates claim an even cut of bloom, of higher grade through the season, with better stems and less disease. They admit the system requires more labor, expense, and closer attention, which is offset by an increased price for the higher quality of goods. Some indoor growers turn their plants out of two and one-half inch pots the first of April directly in the soil on the benches in the house where they are to remain during their blooming season. They will commence flowering about the first of October, thus giving a supply at a period when carnation flowers are scarce.

Mr. Hartshorn grows his carnations outdoors for eight or ten weeks and then removes them to the house bench—a compromise between the two methods.

Glass affords the plants a more uniform temperature and light. Light intensifies the colors of flowers, as is observable in all countries with cloudless skies. Dr. Beneck, an eminent vegetable physiologist of Europe, says: "Light tends to develop the reproductive over the vegetative elements of plants." This implies its floral features. Love is the ardor of an animal's desires; a flower is the heat of a plant's passion; the perpetuation of its species is its only object; to fructify and live again in vital seeds is a plant's final aim and destiny. Flowers are not aureoled with beauty for men to admire. They don their crowns of gaudy colors and fling their perfume on the ambient airs to cajole the bees to Adonean

feasts. When a plant feels the tread of pollen-shod feet of insects on the dias of its petals, it swoons to coma with the delirium of rounded life; its end is attained, its destiny fulfilled.

It is not strange that carnations should exploit their best floral efforts for the only object for which they live under the electric stimulus of intensified sunbeams. House for growing carnations through the summer under glass should be contrived for the greatest possible ventilation. Light is the conjuror of better blooms, not heat. The side and central ventilators should remain constantly open until the outside temperature falls below 40 degrees at night. Plants for indoor culture are struck about the same time as for the common system of culture and carried thriftily forward in pots, until about the first of July, in cold frames, when they are transplanted on the beds, or benches in the house. All growers now bench their field carnations from one to two months earlier than they did ten years ago.

Growing carnations under glass is a matter of market. If a grower can realize more money for a less number of high grade flowers than he can for a greater number of moderate quality, he should experiment with the glass system. There are some varieties of the carnation family that are better adapted for growing under glass than others, but the practice has not yet developed the catalogue. Jubilee, Triumph, J. Dean are mentioned, while Buttercup is specifically regarded as undergoing a palingenesia by the thaumaturgy of summer glass.

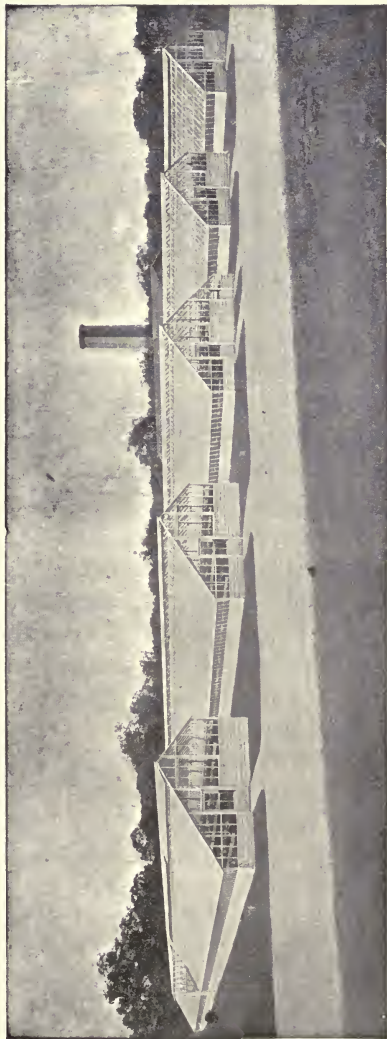
CHAPTER XVI.

SUNLIGHT AND VENTILATION PRIME FACTORS IN CONSTRUCT- ING CARNATION HOUSES—BUTTING GLASS—HEAT- ING—RADIATING SURFACE REQUIRED FOR GLASS SURFACE.

IT is not designed to give details relative to glass houses for forcing carnations, but to allude to a few of the main features that should be in houses to supply the most imperative demands of carnation plants. In the architectural construction, heating and ventilating plant houses there are firms with great experience and large capital who have spent their lives in perfecting these several departments. They must be deferred to.

There are but three primary systems for heating greenhouses, the brick flue, hot water, and steam methods. They are evolutionary. For a small glass surface, say two or three, eleven by forty-foot houses, with the absolute certainty that there would never be a demand for an increased capacity, I would use the old brick flue as the cheapest and the best primary school in floriculture, and equal to the means of some and the ambition of others. Floriculture is centralizing and capitalizing and in its larger centers of trade where capacity and facilities are great for growing carnation flowers for market there would be a hazy hope of success from the flue system of heating.

For a larger area of glass, hot water can be adopted with successful results. With a large extent of glass and a corresponding value of stock to be cared for, a stoker and night watchman are imperatively demanded. The steam system comes to the front as the ultimate in greenhouse heating until Thermo-Electricity is successfully installed. The relative cost of hot water and steam for any definite quantity of glass can be more certainly obtained by



A well lighted and ventilated range of five three-quarter span greenhouses, 300 feet long, with connecting passages and well planned for the successful raising of carnations. Designed and erected recently by the old reliable firm of Hitchings & Co. in Rowayton, Conn.

addressing the old reliable firm of Hitchings & Co., who keep more fully abreast of all progress of heating, than can be given in this work.

The internal arrangement of carnation houses, relative to benches, solid beds, overhead surface, and sub-watering has been exhaustively treated under these respective captions.

I desire to speak of locations for carnation houses, and emphasize *sun-light* and *aeration* as prime factors in growing good carnations. Houses should be located and constructed to afford the plants the fullest extent of these beneficences. The physical anatomy of the carnation plant, the functions of its organs, and years of observation, point to the great importance of these neglected features in houses constructed for growing carnations.

R. W. Winterstatter's tables, relating to the flowering of carnations, are the most accurate ever given to the carnation public. They clearly establish the productiveness of bloom; that quality and quantity largely depend on sunlight and ventilation.

The marvelous mechanical devices for ventilation leave little to be desired in this particular. Profuse ventilation is an ascending note in the scale of successful house culture of carnations. Fire in the furnace and the ventilators frequently and reasonably raised, superficially seems a solecism, but profoundly it is philosophy, experience, health and vigor for carnation plants.

All carnation houses should be located to secure the greatest amount and longest duration of sunlight through the winter months. It is an established physiological fact, that light powerfully stimulates the reproductive forces of plants (which implies flowering) at the expense of their vegetative or structural development. This is illustrated by the immense blooms on small plants grown under unshaded glass during summer months.

Much importance attaches to little things in growing carnations. Little things make "*quality*." "*Quality*" is the cry of the purchasing public, "*quality*" has been the shibboleth of those who have won fortune and fame, in growing carnations.

Butting glass in green houses with an intervening metallic strip was deemed the perfection of mechanical ingenuity, is now

generally discarded. It is one of the misfits between theory and practice that often occurs.

It may be of interest to give tables prepared by B. A. Dudley, representing a reliable heating and ventilating manufacturing company. The following will be found a safe proportionment of heating surface to glass surface for various temperatures in the greenhouses, when the temperature is at zero outside, with not to exceed five pounds steam pressure at the boiler:

TABLE I.

PROPORTION OF HEATING TO GLASS SURFACE FOR MAINTAINING DIFFERENT TEMPERATURES IN GREENHOUSES.

Temperature.	Heating Surface	Glass Surface.
70 degrees.	1 square foot.	5 square feet.
65 "	1 "	5½ "
60 "	1 "	6 "
55 "	1 "	6½ "
50 "	1 "	7 "
45 "	1 "	8 "
40 "	1 "	9 "

Having determined the amount of heating surface, the next point is its distribution, and for this nothing gives better results than the "over-head" and "under-bed" system. This system consists in carrying the flows through the peak of the house to the end farthest from the boiler, then dropping and returning in small pipes, preferably one-inch under the beds.

TABLE II.

RADIATING SURFACE REQUIRED.

Square feet of glass exposure.	Number of Square feet of Radiating Surface Required at				
	40 degrees.	45 degrees.	50 degrees	60 degrees.	70 degrees.
25	2 7-9	3 1-8	3 4-7	4 1-6	5
50	5 5-9	6 1-4	7 1-7	8 1-3	10
75	8	9	10	11	15
100	11	13	14	17	20
200	23	25	30	33	40
300	34	38	43	50	60
400	45	50	57	67	80
500	56	63	72	83	100
1,000	112	125	143	167	200
2,000	223	250	286	333	400
3,000	334	375	429	500	600
4,000	445	500	571	667	800
5,000	556	625	714	833	1,000
10,000	1,112	1,250	1,429	1,667	2,000
20,000	2,223	2,500	2,857	3,333	4,000
30,000	3,334	3,750	4,286	5,000	6,000
40,000	4,445	5,000	5,714	6,667	8,000
50,000	5,556	6,250	7,143	8,333	10,000

TABLE III.

Size of Pipe.	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$
Length of pipe per square foot of radiating surface.	4.502	3.637	2.903	2.301	2.010
Number of square feet in one lineal foot of pipe.	.221	.274	.344	.434	.497
Size of pipe.	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4
Length of pipe per square foot of radiating surface.	1.611	1.328	1.091	.955	.849
Number of square feet in one lineal foot of pipe.	.621	.752	.916	1.044	1.178

Amounts of surface necessary to heat a given amount of glass being figured on the basis that the house is well built, tight, and moderately protected from the prevailing winds. Under these circumstances, it will be found fairly accurate.

The ideal glass house for growing carnations for commercial purposes has not yet been built. Growing carnations under glass through the summer and the removal of them from the field to the benches so much earlier than formerly and long before the hot season, in this latitude, being past, makes the old style greenhouse ill adapted to the changed system of cultivation. They confine suffocating hot air, which natural forces would rapidly equalize with outdoor conditions if given a chance in their construction. Under bench, and side ventilation amounts to but little in a tier of a dozen houses. Front and rear access of air is not esteemed as it should be, and at best is insufficient in long houses. The air must be kept in rapid motion, with the adjuncts of moisture and shade, to maintain a healthy temperature for carnations. I know of a grower that takes out a row of glass along the heel of the rafters during summer with noticeable benefit to his plants.

There is a field open for cheap and practical improvements in greenhouse structures in adapting them the better for growing carnations under glass in either summer or winter weather.

The Dale Estate greenhouses at Brampton, Ontario, are 840 feet long and 8 in number. They are supported by a trussed roof, contain tile beds raised 16 inches from the ground. The Massachusetts experimental station, after conclusive trials, says that all plants make better growth with the heating pipes under the benches. The under bench system of heating consumes less fuel. Water leaving the boilers, at 120 degrees Fahr., will maintain a temperature in the same house, 6 degrees higher, with the pipes under the benches, as against the overhead system of heating.

**EGYPT.**

This carnation originated with Weber & Sons, Oakland, Md., and was disseminated in 1901.

CHAPTER XVII.

FERTILIZERS FOR CARNATIONS—FORMULAS—EFFECT OF CARNATION NUTRIENTS—EXACT ELEMENTS IN A GIVEN QUALITY OF CARNATION STEMS, ROOTS AND LEAVES.

EXCESS of assimilated nutriment unbalances the vegetative and reproductive forces in both animals and plants. A fat animal looses its desire to cohabit, and its power to conceive. A potato will yield no tubers on a dung hill, nor will a rapidly growing tree produce any fruit. An abnormally robust carnation plant will produce no flowers. When nature extravagantly expends on one side, it economizes on the other. A blossom is the heat of a plant's passion, as love is the ardor of an animal's desire. The number of flowers that a plant will yield is in the inverse ratio to its abnormal foliage. A carnation plant whose vegetative force has over-balanced its reproductive energies, cannot be equalized during its brief existence. It may be fed up, but never dieted down. It is a disease, a destruction of the equilibrium between the assimilating and excretory forces of the organism.

The drift is toward chemical combinations for fertilizing carnations; but I think the uncompounded nutriments, such as gound bone, lime, wood ashes, cow and sheep manure, are safer and better. Nature would not have constructed a laboratory of vital synthetical chemistry in the penetralia of a plant system if it had designed man to operate its nutrient pharmacy.

Soil favorable to the growth of the primal *Dianthus* family contained but little humus, and all vestiges of ancestry in plants or animals are never completely obliterated in their progeny. A carnation grower asks through a recent trade journal, "What is the matter with my carnation plants? I made the bench soil out of

half rotted manure, fertilize once a week with manure water. They are robust and vigorous plants, but won't give much bloom, and what few they do afford are small and indifferent." The Carnation Editor without elucidating the law of vegetable life, replied. "They will all come right." Healthy equalization of life forces will not occur in their brief existence. The questioner can cart his carnation brush to the compost pile in June without enough flowers to pay him for the heat and humus he has used.

A carnation should be started on plain food. It can be fed up to physical excellence, and grand flowers. There is no reliable anti-fat remedy known. A fat animal is comparatively barren. A fat, or over-fed carnation plant is equally so of flowers. They are but an incident in the process of fecundity.

Formerly soils were analyzed, and the food for plants inferred. Now plants are analyzed and their food requirements supplied. To know what elements a plant is composed of is to know the nutriment it needs. A reliable analysis of a definite quantity of normal carnations, embracing roots, stems and leaves, by Martin Smith, shows they are composed of 73.4 per cent water, 26.6 per cent dry matter, which was resolved into

Silica.....	4.63
Iron and Alumina.....	21.33
Carbonate of Lime.....	22.61
Magnesia... ..	2.18
Potash	29.16
Soda	2.88
Sulphuric Acid.....	3.16
Phosphoric Acid.....	12.56
Carbonic Acid Chlorine etc..	1.49

100.00

This analysis is significant and conclusive in showing the mineral elements needed in the chemical fertilizers, and vindicates the experiments of fertilizers made by the Massachusetts station on carnations under glass. Out of thirteen different compounds, the one containing Sulphate of Potash with Sulphate of Ammonia gave the best results as to vigor of the plants and the

productiveness of bloom; and out of six tests of single fertilizers Nitrate of Potash gave the best results. Need theory, experience, and philosophy, on fertilizers for carnation seek any more conclusive information?

The consensus of opinion today is, that partially decayed manure is positively injurious to carnation plants, and no matter how well rotted, it does not contain all the elements of food that carnations need for their highest development.

There is a growing trend towards the use of chemical carnation nutriment. The chemical and physiological knowledge now possessed of plants, points to phosphoric acid, potash, and nitrogen, as the three prime elements in plant growth, and all fertilizers should possess one or more of these elements in some form.

Prof. Weyman's great fertilizing formula contains all the mineral elements of carnation food.

Phosphate of ammonia.....	2 oz.
Nitrate of Soda.....	$1\frac{3}{4}$ oz.
Sulphate of ammonia.....	$1\frac{3}{4}$ oz.
Water.....	50 gal.

Mix and use a light application to the soil every ten days.

A very successful carnation grower for a top dressing on his carnation benches, uses

Screened stable manure.....	4 bushels.
Ground bone.....	$\frac{1}{2}$ peck.
Wood ashes.....	$\frac{1}{2}$ bushel.
Slacked lime.....	$\frac{1}{2}$ peck.

Ground bone and the potash in wood ashes are always in order. Sheep manure is rich in nitrogen and phosphorus. Ground bone and well rotted manure is one of the best fertilizers for carnations, both in the field and on the benches.

The following formulas possess, theoretically, the best carnation food, while for efficiency they have been practically tested:

Nitrate of Soda.....	31 lbs.
Sulphate of Ammonia.....	13 lbs.
Phosphoric Acid.....	130 lbs.
Sulphate of Potash.....	26 lbs.

Thoroughly mix, and dissolve one pound in sixteen gallons of water and use two gallons to a square yard of bench surface every two weeks.

Mulching carnation beds is esteemed by some as a valuable mode of fertilizing the soil. Well rotted, finely sifted manure makes a good mulch.

All liquid food as a stimulus for plants should be used weak and often, rather than strong and infrequently. Since the introduction of carnations there is no record of showers of quails and manna, or liquid phosphate and nitrogen. A successful grower uses the following fertilizing formula:

Sheep manure.....	1 peck.
Nitrate of Soda.....	2 quarts.
Cow manure.	3 pecks.
Water.....	50 gallons.

Mix and apply on the benches moderately every two weeks.

The physiology of a carnation plant is to send its feeding rootlets toward the surface for its supply of nourishment. The carnation grower that mulches with sheep, cow or well rotted stable manure, and judiciously uses on the surface fine ground bone, and Prof. Weyman's fertilizing formula, can depend upon acting in harmony with the plant's nature, and in furnishing it with the most healthful and essential food nutrients.

Growers are given to putting too highly enriched soil in the start on the benches, avoiding this error, there is epitomized in this chapter the essence of all that is known, or will be known, relative to carnation fertilization. But the last word has never yet been said on any subject; nature enjoins "Finis" being written in any volume of her unfolding scriptures.

Dianthus Superba, that has been evolved, requires more moisture and humus and less mineral elements for nutriment, than *Dianthus Semperflorens*.



SWAYNE AND LAMBORN.

Originated by Edward Swayne, Kennett Square, Pa. Disseminated in 1888.

CHAPTER XVIII.

DISEASES OF CARNATIONS CAUSED BY INSECTS—GREENFLY

(*Rhopalosiphum Dianthi*) — RED SPIDER (*Tetranychus*

Telarius)—NEMATODE (*Heterodera Radicicola*)—

THRIPS—REMEDIES.

CARNATIONS in the United States are freer from all kinds of diseases than they were five years ago. The epidemic of Rust that occurred in the early nineties threatened the continued cultivation of carnations, and frightened growers into radical precautionary measures to secure the health for their plants, in all the phases of their life, between the cutting bench and the compost pile. There is no disease of carnations the grower now need fear, if he starts with healthy cuttings and follows them through their mutations with the best known hygienic conditions.

Growers must abandon the idea that their duties consist in mixing villanous compounds for carnation ailments, and making their greenhouses hospitals for diseased ones, or sanitariums for their recovery. The prophylactic method is the only one on which to grow carnations. The pharmacy must be preventive, not curative; and their nutrients normal and not concocted. It is enough to give carnations vital paresis to carry the ponderous names professors from experimental stations give to their real and imaginary maladies.

To the common mind the Etiology, Pathology and Therapeutics of carnation diseases are as nebulous as was Heckel's chaotic ether, out of which he moulded worlds.

GREENFLY (*Rhopalosiphum Dianthi*.)

All the serious troubles which assail carnations arrange themselves under the heads of *insect* and *fungous* enemies. Of these the Greenfly is the sapper and miner and leads the enemies, as-

saults on the citidel of the carnation's life. Professor Theodore Woods, of the United States Agricultural Department says :

"There is not a plant or tree, wild or cultivated, that escapes the ravages of this pest, and of all the beings that rank under the head of injurious insects there is not one capable of causing more distruction than the Greenfly."

Both the primary and secondary effect of the piercings of an Aphid makes it the carnation's greatest enemy, its powers of multiplication are so enormously rapid, that, abetted by the Locust and San Jose scale, if they were not restrained by destructive enemies of their own, would soon denude the world of vegetation. Like the barbarians from the northern hive that overran and destroyed Roman civilization in the fifth century, the Aphides feed upon everything that floats the plasm of vegetable life. Entomologists say its most delectable menu is the rich blood of the Dianthus genus of plants.

This insect is too well known to need any description. It multiplies by agamic reproduction. Little cells, or nodes develop on the inner walls of the parent's abdomen, which are rapidly detached, and in a few hours are delivered by its parent as live Aphides. Remeur estimates that one Aphid may be the progenitor of 6,000,000 lineal descendants in a single season. They breathe through openings in their sides. Some of their offspring have wings so they may more easily scatter their countless numbers. Their mode of continuing their species is an exact duplication of continuing carnations by cuttings. It is recommended to the consideration of advocates of the *running-out* theory. Long years of agamic life has entailed no degeneracy on the Greenfly. It is as virile today as when its first parent thrust its proboscis into the prótoplasm of a dianthus leaf. The voracity of the Greenfly is only equaled by its prodigious geometrical powers of multiplication. They feed like vampires on the vegetable



An Aphid, highly magnified.

blood of plants; their organisms are minature sugar refineries, converting great quantities of elaborated life sustaining elements in the vital sap into what is called "honey dew" on which termites, or ants, greedily subsist. Like the fabled filthy Harpies, sent by Juno to destroy the tables of Pheneas, the lances of these green-coated myrids are tipped with poison, and a train of devastating evils follow in their wake. They deposite a virus in the plasm of the leaf fatal to life, and the cells collapse and die. They open lesions on stems and leaves in which the leprosy of Rust germinates its spores.

Professor Woods has been unable to inoculate a healthy carnation leaf with the Fungi of Rust, the leaf must first have its epidermis lesioned, or perforated by puncturing pests. (The first part of the next chapter makes consecutive reading with this.)

REMEDY.

Spraying water with force will knock many Aphides from their lodgments on affected plants, but the older ones soon regain their feeding grounds. The fumes of tobacco are a specific for Greenflies. This is so cheap, effective and easily applied, it is useless to seek other remedies. The tobacco smoke can only be applied in an enclosure capable of confining the smoke for a time for respiration by the insects. The narcotic principle in tobacco, so poisonous to Aphides, is called nicotine. Tobacco stems are chiefly obtained in bales from tobacco factories at little cost, to possess their full Aphides toxin they must be fresh, and should be dampened before being burned in the greenhouses, this causes them to give out a slower, denser and cooler volume of smoke. Every carnation house should be fumigated once a week with tobacco, without any reference to an observable appearance of the Greenfly. A bushel of tobacco stems is sufficient for a large house if used as a preventive. Nicotine is a specific for Aphides, Red Spider and Thrips. Flowers should always be picked before the house is fumigated; they keep better and the odor of tobacco is dissipated before they are ready to be re-picked.

The United States department of Agriculture has experimented with fifteen remedies for Greenfly, and the most effective one is resin, dissolved in caustic soda. Its effect is said to be marked and immediate. The active principle of tobacco is offered in commerce under the name of nicotine and used as a spray by dissolving half a pint in three gallons of water. Resin, dissolved in carbon oil, is recommended. Tobacco stems, steeped in water until it is the color of coffee, and applied as a spray is effective. A teaspoonful of pyrethum, dissolved in two gallons of water, used as a spray, will also exterminate the Greenfly.

The formula for fumigating with hydrocyanic acid gas, is ninety-eight per cent cyanide of potash, one half ounce, one ounce of sulphuric acid, and three ounces of water for every 1500 cubic feet of house space. The fumes should continue through the night. This is one of the most powerful and deadly poisons known to pharmacy and should be used with the greatest care.

RED SPIDER (*Tetranychus Telarius.*)

The entomological history of this insect is yet to be written. The broods hatch from eggs, and their rate of multiplication is considered equal to that of the Greenfly. It spins a delicate web over the leaves, and subsists on the vital juices of the plant. A dry atmosphere and fire heat favors the reproduction of this pest. It is not confined alone to greenhouses, but the vegetable world is its habitat, and the juices of most species of plants, its food.

REMEDIES.

Syringing with water has but a temporary effect. Maintaining an atmosphere in the house of seventy-five degrees of hygrometric moisture is not inimicable to the health of plants and is fatal to the Red Spider. Spraying with two ounces of Ivory soap in two gallons of water will bring the Red Spider under control.

Another remedy: Take four pounds of Chloride of Sodium (common salt), to fifty gallons of water and use as a fine spray is alleged to be an effective remedy.

THRIPS.

These pests have wings and six legs, are quick and active, making short flights, giving the appearance of hopping. They attack carnations in the field, and are carried into the houses with the plants. Thrips work their way through the calyxes when carnations are developing their buds, feed on the tender petals, and lay their eggs on the inner side and upper end of the calyx valves. In these crypts they are largely immune from fumes and sprays. There are but few localities in the states where Thrips



Appearance of shoot affected by carnation Thrip or Twitter.

are troublesome. They are a hard enemy to combat, being encased in the tissue of the plants, tobacco fumes so feebly narcotize Thrips that they mostly recover from the stupor. They are most common with plants grown in sandy soil.

REMEDY.

Caustic Potash.....	1 lb.
Fish Oil.....	3 pts.
Soft water.....	2 gals.

Dissolve the potash in water, add the water, boil and stir for half an hour, use when cold as a spray. This is considered the

most effective remedy known, for Thrips, Greenfly and Red Spider; but there will be some so secreted they cannot be reached without successive applications.

ROOT NEMATODE (*Hiterodera Radicicola*.)

This disease was first noticed in 1885. Symptoms are a browning and shriveling of the plant's tissues, usually on one side, from below upward, involving finally the death of the whole plant. On the medium size roots may be found galls, about an eighth of an inch in diameter, and these little galls, or nodules, contain the eggs of the Nematode, which hatch into worms, that migrate to fresh roots and repeat generation. Prof. Atkinson at first described the pathology of this disease. Fortunately it is not very common, and is most likely to occur in soil taken from under trees, or near hedges.

REMEDY.

The only remedy suggested is sterilizing the soil before it is put on the benches, by steam heat, to a point that would destroy all germs of this life.

CHAPTER XIX.

DISEASES OF CARNATIONS FROM FUNGI, RUST (*Uromyces Caryophyllinus*)—WET STEM ROT (*Rhizoctonia*)—DRY STEM ROT (*Fusarium*)—SPOT DISEASE (*Septoria Dianthi*)—
FAIRY RING (*Heterosporium Echinulatum.*)
—REMEDIES.

THIS destructive disease appeared as an epidemic in 1892, it seems now to be under control from the use of fungicides, and better sanitary conditions in carnation houses. The presence of Rust can be detected by spots on the leaves and stems, looking like little blisters, under which there is a fine snuff-colored dust. The covering of this dark powder is a semi-pellucid layer of the plant's epidermis. When it is broken a cloud of spores is released to scatter the infection, when the blister does not yield this dark powder it is not Rust. However fatal fungicides may be to active or dormant spores, it is difficult to reach those shielded by a layer of skin on the plant's leaves.

CARNATION RUST (*Uromyces Caryophyllinus.*)

Prof. A. Woods, chief of the division of vegetable physiology, U. S. department of agriculture, in a formal address takes a radically new ground on the causes of bacterial diseases of carnations. He says the old name "Bacteriosis" for that class of carnation diseases should be dropped as inappropriate, and "Stigmose" or "punctured disease" substituted; that the bacteria found on carnations are the results of the poisonous punctures of the Greenfly, Red Spider, and Thrips. Prof. Woods supports his pathological theory with cogent facts and illustrations. Suppuration in a wound is caused by bacteria and is obviated by sterilized and germicidal dressings. It is reasonable that the ever present spores of Rust would find lodgment and germinate in wounds of

a plant's tissues, in which case they cannot be considered the primary cause, but a resulting aggravation.

"Stigmonose" is the combination of two Greek words meaning a disease resulting from stinging or piercing. Prof. Woods originated the word and revolutionized the etiology and pathology of the "Rust" disease. Prof. Woods and Dr. Bissy both have ineffectually tried to inoculate a healthy matured carnation leaf with Rust spores; and they had not the power to penetrate the waxy bloom on the epidermis of the foliage. They must find a lodgment in a lesion or puncture to multiply their million spores. Prof. Halstead of Rutters College, N. J., thinks the spores of Rust find lodgment and vegetate in the stoma, or breathing pores of the leaves of carnations.

It is asserted with microscopic assurance that the gossamer filaments of Rust roots penetrate every part of the plant's structure, even to their roots, and thus assail the vigor of the plant's constitution, and continue the leprosy in its cuttings. If the ruinous effect of the Rust were confined to the local spots where the blisters appear, it would be robbed of its terrors. But its roots permeate the entire organism of the plant. It feeds as voraciously on the vital essence of the plant as its spores are countless in their numbers. Rust sends out its thread-like roots into every ward of the plant's system, to feed on the sugar and vital pabulum that the plant elaborates to keep alive its vital fire of life, and the plant declines and dies in the merciless grasp of the root-tentacles of this insidious vegetable Octopus. Prof. Woods asserts Rust spores vegetate in lesions of the plant's leaves, I maintain it is in the plants and cuttings by division of its roots. A carnation plant constitutionally effected with this terrible parasite can never be cured.

Dropping the continuity of the gossamer roots of this Fungi through the structure of the plant's organism and accepting the stage of its development referred to by Prof. Dana, in which segments of these penetrating radicals are seen with a microscope, floating in the plasm of the principal cells of the plant, make it easy to conceive how closely this fungus is associated with the

plant's life. Life lives in cells, cells are the primal units of life. A cutting consists of thousands associated cells. A carnation cutting, apparently healthy, taken from a Rust diseased plant, will develop the disease in the cutting bench, which can only be done by transmission of the malady to the progeny by root germs.

This theory of the etiology, and pathology of the Rust Disease, is supported by facts and unravels many paradoxes and solves riddles of the sphinx. It explains why cuttings are attacked with Rust in the propagating bench. Why a variety exempt one season is affected the next; why measures against it must be prophylactic and not remedial; why some plants seems to be immunes to Rust when their close neighbors are badly affected; why promising new varieties as Blanch, Edna Craig, Jacqueminot, Uncle John, and others, having contracted Rust constitution, transmitted them and were soon dropped from the roster of commercial varieties.

The importance of Bacteria lies in their insignificance. Their strength is in their weakness, their devastation in their unseen methods. The aggregation of atomic forces works amazing results; the coral insect builds rock-based islands in the ocean.

The following formulas as preventative therapeutics for Rust are invaluable and should never be neglected. Some are said to be specifics for Rust in the initiative and local phase of its progress.



Fig. 1.

Leaf of Carnation, with several rust pustules.

Prophylactic treatment is the only cure for Rust, but it can be held in check by the use of various fungicides.

REMEDIES.

Mr. Dorner's formula has proven effective for pustules. It is as follows:

Sulphate of copper.....	1 lb.
Ammonia.....	2 qts.
Soft Water.....	6 qts.

To one pint of this mixture add two quarts of Ammonia, stirred in a barrel of water and the plants should be well syringed every two weeks on a clear day.

The following formulas have been experimented with, giving substantially the same beneficial results:

The liquid Bordeaux mixture consists of

Copper Sulphate.....	6 lbs.
Quick Lime.....	5 lbs.
Water..	22 gals.

Chloride Copper.....	3 oz.
Water.....	22 gals.

Sulphide of Potassium.....	2 oz.
Water.....	22 gals.

Arsenical formula for Rust:

Arsenous Acid.....	616 grains.
Carbonate of Potash.....	1236 ounces.
Water.....	5 ounces.

Heat to make the solution. One ounce to a gallon of water, used as a spray. It is asserted this will not only check but exterminate Rust.

Mr. C. W. Ward's treatment is prophylactic and effective, I quote his own language:

DIPPING. — All young plants are immersed in the liquid Bordeaux mixture when set in the open ground. All mature plants are immersed (tops only, not the roots) in the same mixture when benched in.

SPRAYING.—All young plants are sprayed with either the liquid Bordeaux or ammonia solution once in two weeks while under glass, and all field plants are sprayed the same in field..

FOSTITE —Under glass all plant houses are blown full of Fostite in a fine cloud, every dark, cloudy day.

Dry Bordeaux is sprinkled over all paths and under all benches every two months.

Carnation plants should not be syringed if any trace of Rust or Spot is about the premises. All diseased plants should be promptly burned.

By the above means we have not had a trace of rust on our stock."

FAIRY RINGS (*Heterosporium Echinulatum.*)

This is a trouble easily controlled by using a half-pound of carbolic acid diluted, and used as a spray.

FUNGUS IN THE CUTTING BENCH.

This variety of Fungus is believed to be identical with the one causing wet stem rot (*Rhizoctonia*), the conditions being similar for its development in both instances, a close atmosphere, moisture, heat and decaying vegetable elements in the bench-sand is the cause of *Rhizoctonia* in the cutting bench.

REMEDY.

Use sand, free from all impurities, renew it once a year, white-wash the bottom and sides of the bench with fresh slacked lime before it is filled with sand, and there will be no trouble from this fungus.

WET STEM ROT (*Rhizoctonia.*)

This disease affects carnations in the field and on the benches, and sometimes is very destructive. It is characterized by a moist condition of the skin on the stem of the plant. If it is twisted, the bark or skin will be found dead and disconnected with the sub-tissue. It is most likely to occur on plants of a soft growth, in hot weather, deficient light, wet spongy soil, that contains much decaying organic matter, poor drainage and imperfect circulation of air. Prof. Woods says it is caused by a fungus that may be detected by the unassisted eye, and is favored by acid soils, excess of heat, moisture and manure. Lime will reduce its frequency.

The Geneva experimental station has discovered it on thirty species of cultivated plants. It causes leaf rot in lettuce and is the fungus of the cutting bench. It is propagated through the soil and not the air.

REMEDY.

Reverse abnormal conditions with cultural methods. Lime as a remedy is indicated by Mr. Scott, who is an extensive carnation grower, in a soil strongly impregnated with lime, and reports substantially no stem rot. Mr. May, an observing cultivator of carnations, says he lost seventy-five per cent of his plants with stem rot, but after giving his soil fifty bushels of lime to the acre, has grown carnations on the same land without any stem rot trouble. This fungus spreads slowly through the soil, but never through the air. It luxuriates in moist decaying vegetable matter and attacks the stems and roots of carnations and other plants.

SPOT DISEASE (*Septoria Dianthi*.)

This disease was first noticed in 1889. It is recognized by roundish spots on the leaves and stems of the plant, has a pale yellowish color on the margin of the healthy tissue around which is a tinge of purple or red. The spots are easily distinguished from either side of the leaf, there are numerous black dots scattered over the pale area, which gives the name to the disease.

REMEDY.

Make a strong tea of *Coccus Indicus*, also a tea equally as strong of Quassa, a half-pound of carbolic acid. To each half pint of above add ten grains of corrosive sublimate. Use one tablespoonful to one gallon of water, as a spray.

DRY STEM ROT (*Fusarium*.)

This is another disease of the stem of the carnation plant, but not so general as the other. It is caused by a fungus that develops in the capillary vessels of the stem, causing it to become dead, dry, hard and stringy. Prof. Woods says this fungus thrives in a reverse condition of the soil favorable for the "Wet

Stem Rot," and flourishes best in soil with an alkaline reaction, and is a close relation of the fungus that is driving the cotton industry out of North and South Carolina.

REMEDY.

None is definitely known. The fungus is in the soil. It is possible to sterilize the soil on benches with steam, but it is not practical in the field.



Courtesy of T. R. Pierson Co.

MRS. THOMAS W. LAWSON.

The alleged \$30,000 Carnation, showing the Silver Cups awarded it.

CHAPTER XX.

NUTRIENT DISEASES—INCIDENTAL PESTS—COHERING PETALS
—BARREN CARNATIONS—PURPLE JOINT (*Rosette*)—RUP-
TURED CALYXES—DOUBLE FLOWERING CARNATIONS.

NATURE and æthetics revolt at a ruptured calyx. Their sweetest lyric is a perfect flower. The unfoldment of carnations has been along lines of least resistance. It is easier for vital force to multiply and broaden petals, than to increase the capacity of the calyx to accomodate them. Double flowers are abnormal, and it is not strange the process by which they are reached from the single flowering state should be marked by inharmony of structural development, the law of co-relation being broken in its evolutionary march between the petal sand the calyx.

The petals of a carnation flower contain different elements, on analysis, from any other part of the plant. They inhale oxygen and exhale carbonic acid gas, reversing the function of the foliage. The calyx is composed of slow growing and strong fibers, feebly connected with each other, and easily torn apart, while the petals are soft, vascular, and grow rapidly; the sun paints the plant green with chlorophyll, and the petals with a paradise of colors. It is reasonable a hiatus should occur between the natural and artificial, the calyx and petals, where difference in structures, functions and momentums of life meet. A bursting carnation can never be cured. Mrs. Carnegie, one of the best white-variegated varieties, was an immune to all remedies, lived with this disease and died with its terrors.

Bursting is aggravated by sudden changes of temperature and imperfect ventilation. The calyx is strengthened by air and light, given to buds on well supported stems. Heat also lengthens the claws of the petals and lifts their breadth farther out of the mouth of the calyx. Nature and selection, in cross-fertilization, is co-ordi-

nating the calyx and petal differences. The time is coming when a bursted carnation will be regarded as anomalous. Ten out of the thirty-six new carnations of 1901, the originators assert, *never* burst their calyxes.

From a strictly botanical point of view the double flowering carnation is itself a nutrient disease. It is the product of domestication, enforced selection, high culture and stimulating fertilization. This is what has doubled its corolla, metamorphosed its stamens into petals, aborted its organs of generation, and largely barred it of the powers of reproduction. Some varieties of carnations have only sexual vestiges, others have stamens and no stigma, others stigma and no stamens. Yet it is a disease the world adores. Like immortality, if untrue, is still a sweet delusive dream that men hug fondly to their hearts.

BARREN CARNATIONS.

Very robust and vigorous growing carnations will sometimes refuse to bloom, or what few flowers they do afford are small and indifferent. Such carnations are diseased, there is a loss of equilibrium between their absorbing and exhaling forces, the vegetative activities of the plants have extinguished their reproductive natures, a fat animal has little desire, and less ability to reproduce itself. Its life forces are concerned in manufacturing fat which supplants the inclination to procreate. Carnation plants that lose this equipoise have always fat or overgrown vegetative organs and functions, and are comparatively worthless, the counterpoise equilibrium cannot be re-established during their short lives. It is caused by the continued use of rich stimulating nutrients.

COHERING PETALS.

Some varieties of carnations, at times, exude a sticky substance in their buds which causes the petals to adhere to each other, the bud to become deformed, and the flower worthless.

This is caused by deranged nutritive functions of the plant, from some unhealthy food element in the soil. Some ascribe the cause to extremes of heat between day and night temperatures,

but the true pathology of cohering petals is an excess of stimulating nutrients given the plants.

PURPLE JOINTS (*Rosette*.)

It is distinguished by a purple rosette, or coloring around the joints. Neither the pathology or remedies for this trouble are well understood. It is thought to be caused by overhead watering, and the retention of water at the axil of the leaf, and draining local nutrient forces of the plant, if this is the case, the remedy suggests itself. Fortunately the disease is very rare in this country.

I have described all the diseases carnations are subject to in America, in a brief and simple way, so any one with a \$1.50 pocket microscope can determine for himself the nature of the trouble with his plants. I have given the most reliable remedies, and the most effective insecticide, germicide and fungicide formulas known to the carnation growing profession.

There are other incidental or transient pests which assail the carnation crop, such as Ants (*Termites flavipes*), Rose leaf Tyer (*Cacoecia rosaceana*), Cabbage Looper (*Plusia brassicae*), Variegated cut worm (*Peridroma sancia*). The Ants rendezvous in decaying wood about the house; especially favorable encampments are worm-eaten locust posts.

But these assailants are causal or fortuitous, and the good judgment of every carnation grower will suggest an efficient remedy.

MICE.

Mice at times do great damage by cutting and feeding on carnation plants on the benches.

REMEDY.

Keeping a cat in the houses and traps on the benches will soon exterminate them.

GERMS IN BENCH SOIL.

Soil for carnation benches taken from under trees, or near hedges contains germs, pupas, grubs and worms. The soil should be sterilized by heat before being used.

CHAPTER XXI.

DO VARIETIES OF CARNATIONS DETERIORATE AND DIE?—
CONTINUING LIFE BY CUTTINGS—A NATURAL AND
VIRILE METHOD—AS PRESERVATIVE AS BY SEED
—OFTEN THE PROCESS INVIGORATES
WEAK SEEDLINGS

EVERY variety of carnation has a distinct character of its own. Ignorance of its requirement extinguishes varieties, by not supplying their unvoiced necessities. The advocates of the "Running Out" theory start with the assumption that the life of every animal, tree and plant is bounded by infancy and old age. This is true of individual organisms, but in no sense applies to the life of varieties or species—men die, but the people live forever. A carnation is a biennial plant, two years being the duration of its life. We know the species has persisted over two thousand years, it has renewed its life a thousand times and is virile today as when Theophrastus picked up the little pendant in the land of Leonadas and exclaimed in admiration, "*Dio-anthus* !" It has been continued by seed. A cutting continues life in a new organism, with new cells and fresh pabulum, as much so as if it originated from a seed. Weakness attaches to both, more to plants germinated from seeds than from cuttings. There is more hereditary degeneracy enfolded in a seed; not one-fourth of carnation seedlings have enough vigor to survive, the rest are enervated, or lapse toward monopetalism, while nearly all cuttings produce robust plants. Propagating by cuttings is a natural process for continuing life. It is simply the *segmentary* method nature adopts in many plants that are the most tenacious of life, and in the *agamic* process in the Zoophyte order of animals. A tomato plant from a cutting will produce thirty per cent more fruit than from a seed. Nature never inaugurated a law of decadence for

her creations, but has written "virility" over the gateway of every avenue of life. Propagating by cuttings is not devitalizing, but still varieties are extinguished. The interest in new varieties works neglect in old ones, hereditary weakness and insidious disease follows in their wake and correspondingly in their merits.

Their is no biological law known, why any variety of healthy carnations might not live forever under persistent sanitary regulations, and be as immortal as the fabled Phenix bird that lives singly, but burns itself at stated times on a pyre of spices to rise again from the ashes rejuvenated and persistent.

W. R. Shelmire, a critical and observing grower, thinks propagating by cuttings invigorates the constitution of varieties and in support of the assertion instances Buttercup, Swayne, Lamborn, Century, Tidal Wave, and other varieties that had more robust constitutions when they were supplanted by better kinds than when they were first introduced.

A secret and mysterious fatality has waited on many new and promising carnations. There is a recurrence of some occult hereditary weakness that makes them the prey of bacteriosis, or some other disease. Edna Craig began life most auspiciously. It was disseminated with a blare of trumpets, but was struck with an enfeebling palsy and sank into a soon-forgotten grave. This was the case with "Uncle John," "Stuart," and a score of others that possessed great expectation. It is said the good die young.

When new and better kinds of carnations are introduced, no one is censurable for neglecting old ones; it is the unconscious execution of Nature's law of the "*Survival of the fittest.*" Life lives in cells. They are the units of life in a cutting as in a seed. Both are divorced from the parent plant and bide by nature to continue destiny. The only difference science sees between a cutting and a seed, one continues existing life, the other starts a new one, and age is more robust and virile than infancy.

Buttercup is the product of the first humble parents of Alegatiere's new species of carnations imported to America. It has renewed its life near a third of a century by cuttings since

Charles Starr stood dumb and dizzy before the illuminated letter his tactful fingers had evolved in the "Alphabet of Angels." It is as robust and vigorous today as when nature's Raphael glorified its corolla with witching colors, painted on the petals, in the morning of its natal bloom. Mythology says, but one immortality was granted the twins, Polux and Castor, so they lived and died alternately. Science mocks at the myth that Buttercup is given an immortality that is denied the rest of its species.



TYPE OF CARNATION WITH INDENTED PETALS.

CHAPTER XXII.

LIFE LIVES IN CELLS—CONCEPTION IS BY FISSION OF CELLS
—ORIGIN OF BUD VARIATIONS OR “SPORTS”—
BISexual LIFE IN CARNATIONS—IN ALL
THE MONÆCIAN CLASS OF PLANTS.

LIFE lives in microscopic cells, a cell is the unit of life. A cell enfolds a vital spark. The structure of an elephant or an aphid, is an association of cells, and their lives and physis force is the concerted energy of aggregate cell life. Every vegetable and animal organism is vitalized matter, built out of physis animates. There is no spontaneity in life. Life has never occurred on this ball of dirt without antecedent life since the Creative Fiat first spoke it into a cell of quivering protoplasmic jelly. In the lower order of vegetable existences life is continued by “*segregation*” a segment of the plant separates from the aggregate and lives. Animals much higher than the Zoophyte class continue their species on the same principle and are devoid of generative organs. The execrated greenfly, at whose shrine florists weekly pours the incense of tobacco fumes to propitiate its absence, multiplies its millions by little protuberances on the inner walls of its abdomen, which rapidly detach themselves and are hatched as living flies. In ascending the *Monæcian* order of plants, the male and female organs of generation are joined in the same flower and it requires the male pollen to fertilize the seed. The *male* and *female* forces exist in the same plant, and their respective organs are known as *stamens* and *pistils*.

In the *Diæcian* class of plants the sexes are separated and live in trees and plants springing from different and their own roots. One plant possesses *only* stamens the male organ of generation and pollen the male fertilizing dust; another plant possesses *only* the pistils the female organ of generation with a gummy stigma to receive and retain the male dust.

The carnation belongs to the "Monœcian" class of plants. Male and female cells exist and are associated in the same plant, and circulate in its common blood. The fact of distinct male and female organs in the flower of the same plant proves that bisexual cells conjointly exist as distinct entities in the same plant's organism. Otherwise it could not fertilize its own seed. If bisexual cells do not jointly and harmoniously circulate in the plasm of a carnation plant it could not vitilize its own seed, and both the stamens or pistils in its flowers are useless organs. Carnations blow what botanists call "a perfect flower," meaning a flower capable of fructifying itself and continuing its species independently. Conclusions are so palpable that male and female cells flow in the blood of a carnation plant and polarize their forces in the stamens and pistils during the period of fecundation, that they are the synonyms of facts.

The importance of this physiological fact consists in its being denied, and in its acceptance being the basis of the only rational theory of bud variations that can ever be adduced.

ORIGIN OF BUD VARIATION.

New life comes from the conjugation of vital forces of male and female cells in the ovary of the plant. Necessarily there is some confusion in a plant's circulation at the axis of a leaf about to break into a bud, the walls of bisexual cells are ruptured and they mix and mingle with life as it breaks into a bud which gives this lateral branch a different character from the parent plant. The color of the flower and habit of the branch are as unlike the parent plant from which it grew as if it had been fertilized in the ovary by the ordinary method of pollenization. This strange new branch is called a "*sport*" or "*bud variation*." The difference between a sport and a seedling is bisexual cells by accident mixed and mingled in the germ of a bud, instead of an embryonic germ in the ovary. Chester Pride, Edelweiss, H. Stanley, Starlight, Armazindy, Oregon, and more than twenty-five other sports have been named, disseminated and wore even honors with seedlings. Sports never occur in plants that bear exclusively *male* or *female* flowers, be-

cause their sap circulates only unisexual cells, and bud variations cannot happen unless there is a vital union of diverse sexual cells to work the variation. Strains of plants are produced by high cultural methods, but varieties are the product of sexual forces in the secret crypt of conception.

Sports carry into their constitution tonic and atonic hereditary forces, the same as seedlings. Some are weaker than the parent plant, others stronger, as is Chicago, a sport of Mrs. Bradt. It has a more robust constitution and impressive color than its mother plant. Artificial manipulation has caused carnations to produce more offsprings by this abnormal method than any other class of plants.

Carnations are largely rendered sterile by cross-fertilization and cultural methods, and carried farther from their normal line of life than any other class of plants. Nature's most heroic effort is to continue life when it is threatened with extinction. Culture and selection has largely aborted the stamens and pistils in carnations, destroyed or atrophied these organs of generation, eliminated seed and their power to continue their species. Their existence is threatened, their life is in peril; in three years there would not be a remontant carnation in existence if all art was withdrawn from them.

Nature feeling the terrors of impending extinction provides other avenues for continuing existence and substitutes them for the ones art has closed. She makes the type easily continued by cuttings, and varieties common by the *fission* of sexual cells in the germ of a new branch at the nodes of the plant. The banana was once a seeding plant; evolution changed it to a seedless one. It now carries in its fleshy fruit only vestiges of aborted seeds by which it once was propagated. For the abolished method nature substitutes offsets as the means for its continuance.

Horticulture abolished seed for perpetuating the potato, then Nature placed the germs for persisting its life in the structure of its tubers. As art aborts the fecundity of carnations, nature supplies the defects.

"Sports" are growing more common every year. They are not freaks, but one of Nature's reserved methods for continuing species when its existence is threatened. There is no more mystery in new life by bud variation than from a seed; both are riddles of the sphynx at which the world will ever wonder.

The engraving of the American Flag carnation is a good illustration of a "Sport." It was a bud variation of scarlet Portia. It originated with Mr. Bergman of New Jersey, and was disseminated by the late Peter Henderson, in 1891. It was the most evenly and distinctly marked red and white carnation ever on the market. It also illustrates atavism, or suspended heredity; in its parent Portia and that some of its ancestors were white and partially renewed their features in the carnation American Flag.

The muddy water of the Missouri river flows for miles unmingled with the crystal tide of the Mississippi; in the plasm of Portia flowed unmixed sexual cells, each dowered with pigments of red and white. At the axil of a leaf and at the birth of a bud (which is only a modified birth of a new life) there happened a rupture and mingling of the contents of bisexual cells and a new life mixed and mingled with a birth of new bud. The color of flowers and the life of a plant are things apart. The American Flag and all variegated varieties of carnations show in the *fission* of bisexual cells that there is not a *fusion* of parental colors.

Different sex-cells are the legatees of diverse colors, yet they ebb and flow in harmony in the plasmic current of a carnation's life. The parent cells of the American Flag settled (*out of court*) in the birth of a new bud on an equal division of petaline pigments.

The engraving of American Flag was sent to the author by the late Peter Henderson to illustrate a former edition of AMERICAN CARNATION CULTURE, and is esteemed as a memento of the friendship of a noble man.



AMERICAN FLAG.

CHAPTER XXIII.

GEOGRAPHICAL BOTANY OF THE COMMERICAL DIANTHUS

—PLANTS ARE EASILY MODIFIED BY CONDITIONS—
—SLIGHT CLIMATIC DIFFERENCES IN ADJOINING
COUNTRIES HAVE ENGENDERED NEW SPECIES.

NATURAL adaptation by selection developed the five-petaled pink of Greece into the polypetalous *Dianthus* of Europe, a biennial, bearing the second season only one brief but profuse crop of bloom. Alegatiere in 1848, by artificial polenization, a possibility science had just brought to light, selected two varieties, if not species, crossed fertilized them and obtained a product with a tendency to scatter its bloom through its entire life, instead of bunching it as its parents did in a brief multitudinous crop. From this habit Alegatiere's new variety or species has been called the Remontant Carnation, because it continually remounted itself with flowers. It is also called the *Semperflorens* carnation, *semper* meaning constantly; *florens*, flowers—constantly flowering. It is called carnation, meaning flesh, or flesh colored. There can be no doubt that the carnation had a pink color when thus christened.

Alegatiere's new variety, or improved strain, has diffused itself wherever men love and cultivate flowers. They have differentiated and modified their habits and flowers to meet different climatic conditions.

THE DIANTHUS IN GERMANY.

Eufurt and Quidenburg are the storm centers of the *Dianthus* family of plants in Germany. Seedlings are germinated in frames, under glass; when two or three inches high, they are transplanted to the open field, in rows two feet apart and one foot between the plants, where they will bloom the second season. They are lifted

for market into five and six-inch pots from the field, neatly trimmed and staked, and will throw a remarkable profusion and wealth of bloom. The strains of the varieties grown by the plantsmen are divided in bizzars, flakes, selfs and fancies. The most popular colors are crimson and scarlet with countless varying shades. Special or choice varieties are invariably continued by layering the lower branches of the plants in the field or in the pots.

THE DIANTHUS IN FRANCE.

In France, carnation cuttings are struck early in the fall in cold frames, where they remain through the winter and are transplanted in the open ground early in the spring, where they bloom profusely through the summer. Scarcely one of the hundreds of kinds catalogued in France is recommended for winter blooming. The demand for Dianthus flowers in France is through the summer and fall months, and in the winter and spring in America. The period of demand for flowers helps to fix the type or habits of the plant. They would naturally be bred to meet requirements. There is still another divergent cultivated in France and England called the Malmaison. This variety of Dianthus bears unusually large and showy flowers, the finest specimens measuring six inches in diameter and commands a great price. But few of the *semperflorens* type are grown in England as its muggy winters seem fatal to their success. There is a section of Dianthus called Border Pinks popular in some parts of England and are abundant and attractive bloomers.

The prominence and importance given to the forcing type of carnations in England can be fairly gauged by the new "English Carnation Manual," in which, out of *seventeen* chapters devoted to special types of carnations, but *three* are allotted to the perpetual blooming kind, which absorbs all interest in America.

THE DIANTHUS NORTH AND SOUTH.

To show how quickly isotherms, or the annual average of heat units affect the nature of carnations, I quote a declaration of Mr. Dale, a competent and comprehensive florist of Canada, just on

the *northern* line, yet within the carnation belt, in saying: "they cannot produce as high grade carnation flowers in Canada as 'in the states.'" An experienced and practical floriculturist of St. Louis, just on the *southern* limit of their normal zone, says carnations do not flourish here. Another correspondent from Louisville, Ky., says: "Carnation plants do not succeed here; the summer heat injures the plants and stops their growth." Another writes from Birmingham, Ala., "Carnation flowers are esteemed here. We import the plants in the fall from their habitat, as we do Spirea and Bulbs, flower them under glass during the winter season, then throw them out."

THE DIANTHUS IN CALIFORNIA.

A grower in California writes: "We root our cuttings in sand without artificial heat, plant them out in the yards and lawns in January, if in the field, in rows three feet apart and two feet distant from each other. Plants will bloom in six months and frequently attain a diameter of three feet. A good specimen will blow five hundred blossoms in a season and will continue to bloom until new cuttings begin to flower. We never lift them. They will live several years and are used to decorate lawns; their flowers have but little commercial value. They grow best and burst their calyxes most in our wet season, which corresponds to your winter and bloom and perfect their flowers best in our summer or dry season. Seedlings are treated the same as cuttings; the latter are only used to perpetuate some choice varieties."

Another correspondent writes from San Francisco: "Seivers & Co. are raising fine carnations under glass. Their best variety is Hanna-Hobart, bearing three and a half to four-inch flowers." (Jumbo Hanna has not made her majestic *entree* yet in the *semperflorens* belt.) "John O'Hara is building a house to be filled this fall with Lawson. Crane does not give satisfaction here."

Lawson may maintain its missionary character in California as an exhibition plant, as its originator informs a correspondent through a trade journal that it needs a fifty-five night temperature to keep its calyx from committing *felo de se*.

The normal belt of the forcing carnation leaves all of California to the south, but this marvelous spot of earth has a composite climate of all the zones, with its snow-capped mountains bathed in blue, its foot-hills in perfumed Junes, and the languorous air of its sea-levels kissed and cooled by the ocean's waves, gives it a flora mixed and marvelous.

The essential nature of a carnation can never be modified by cuttings. This is done when bi-sexual cells meet in the socket of the ovule. California carnations are a divergence by generations of life begetments, modified in the act by the sorcery of climate. Mons. Dalmias' "Atim" of Lyons, was the Adam of all the carnations in America, the chemistry of their plasm has been re-composited in the alembic of life by the thaumaturgy of environments. They have conformed to nature's resistless law of the survival of the fittest to live, to meet diverse conditions.

There have been ninety named kinds of carnations introduced from California into the forcing belt; most of them in 1892-3-4 and a few of them catalogued the second season. They all doubtless possessed the latent qualities of being forced, and of perpetual bloom, but required the climate jugglery of fecundation to develop them. Eighty named carnations have been introduced from Europe since the puritan La Puritie landed from its Mayflower. Bouton de' Or was the last imported by Ziengerbel. It was grown in this country privately for years, then put on the market by the Dailedouze Bros. and discarded.

E. Sievers & Co. are growing carnations under glass in California which may tend to redevelop the qualities desired in the carnation belt proper. They have introduced Ethel Crocker with much success and this year California Gold appears. Miss Louise Faber and Purity are named as introductions from the same state.

CHAPTER XXIV.

CARNATIONS THE PRODUCT OF ADAPTATION BY SELECTION— SURVIVAL OF THE FITTEST—ORIGIN OF VARIETIES— BASIS OF SPECIES—FOUNDATION OF GENERA— ESSENCE OF ORDERS.

THE law of adaptation by selection may not be comprehended; it is the process by which carnations have become what they are. Mr. Rudd has stated that he obtained seventy-two carnation seeds from one pod, three times the average number. If Mr. Rudd would sow these seeds, and they all germinated and grew to their blossoming stage, when he would critically review the lot and destroy all that were weak, sickly, single-flowered, off colored, short stemmed, bursted calyxes and procumbent habits, and repeat this operation a number of times during several years until but one was left that approached his ideal of what a carnation should be; then repeat this process on the seed of this sole seedling for forty years, this would be artificially adapting the carnation to his ideal and wants, by selection.

It is estimated by cross-fertilizers that not one seedling in a thousand is worthy even of a name. That one is the originator's darling, he magnifies its merits and minimizes its faults; it is again subjected to the growers, the elective court of last resort. It merges all sentiment and flies the pirate's flag of sordid commercialism, bearing the merciless motto of "*How much money is there in it.*" This is the final verdict on all questions in life, issued daily, by the mercenary parliament of the world's religion.

In 1895 there were six hundred listed carnations in America. Parties organized in the interests of carnations sent one thousand circulars to carnation growers asking them to vote *for* or *against* the merits of each carnation they grew, or knew, and return the

ballot to headquarters. But nine of the list received a majority vote. These were:

Buttercup,	Portia,	Hellen Keller,
Daybreak,	Lizzie McGowen,	Edna Craig,
Grace Wilder,	Tidal Wave,	Sweetbrier.

These were the princes and princesses of the royal blood of the dynasty of *Dio anthos* that ruled the world of flowers in 1895. They were the elective product of half a million seedlings, and the strenuous labor of hundreds of men with tactful fingers for twenty years to enthrone beauty on the mountain's top, where *flora* with flowers teaches worldlings the idiom of angels.

Every carnation that reaches general fame passes through a crucial ordeal and runs a gauntlet of criticism to which no other flower is subjected. Aristocracy in cross-fertilization cuts no figure in its final make up. Silver flagons, gold medals and special premiums of any peregrinating society, mutually admiring each other's products, count for naught on the synthesis of a grand carnation nor settle the toga it will wear.

Nature "adapts by selection" by a similar method, but to a different end. The persistence of the species is its pivotal purpose, the hills and dales are its beds and benches, the clouds its fonts of water, the sun its ceaseless thermal source and the deep blue bending sky its glorious dome of glass. A thousand carnation seeds are scattered by the winds on congenial soil, they germinate and grow, a long drouth occurs and the weakest die, a protracted wet ensues and another lot sickens and succumbs. A protracted freeze happens and the tender ones fall, the weeds choke them, and all but a few of the strongest abandon the struggle for life; vicissitudes of one kind and another assail them until but one is left that is the "survival of the fittest," and the strongest to perpetuate itself. It sows its seed and they are again subjected to the same selective process for generations, and thus the clove-scented species of carnation became established on the shores of the Mediterranean. This is nature's method of "*adaptation by selection*" and originating species, while heredity slowly follows and fixes their permanency.

Heredity and evolution are two forces in Nature. One is prophetic; the other, reminiscent. One seeks to return to primitive types, the other seeks to advance old standards. One yearns for flesh pots; the other, for the promised land.

This simple law accounts for all the capricious habits and modified forms of vegetation in the world. Every species of plants has bands, belts, zones or isothermal lines along which they reach their highest evolution. If they are moved out of their climatic home they sport into different types adapted by climatic selection. Plants as they migrate toward the poles become annuals; toward the equator, perennials. The Nasturtion is an annual vine in the temperate zone; a perennial shrub at the equator. No carnation acclimatized in England, Germany or California ever was, nor can be, immediately successful in the remontant carnation zone in the states.

Heredity is less strenuously impressed on embryonic life. Henzie's White was from imported seed, as were many other excellent varieties. A carnation seed fertilized in Eufurt, if its ancestors possessed the forcing and perpetual blooming features of the Alegatiere type, germinated and grown in Chicago, would strongly incline to the type of carnations grown there. A Laplander's child, born and bred in Boston, would imbibe the habits of the "Hub" and "benevolently assimilate" with the descendants of Miles Standish and Paul Revere. Adaptation starts with *new* life, in the crypt of conception, and not through a line of cuttings, which is the continuance of *old* life. After fifteen generations of life by cuttings, Henzie's White sulkily left the field to better kinds, the same robust, hardy, late blooming carnation as when it started on its conquering career.

Buttercup, the oldest carnation in cultivation, is today the same proud, capricious, Cleopatrian queen, bewitching with its dawn-lit beauty a world of Anthonys, as when it leaped from the tactful fingers of Charles Starr, thirty years ago. Its amazing health and vigorous constitution is a defiant denial that propagating by cuttings is devitalizing and an imperious assertion of the fact that varieties die only from the poison of neglect. Bouton d'

Or was imported by Denny Zingerbel, and after years of cultivation in this country by cuttings, was put on the market by an influential firm to meet the fate of all foreign kinds, unnaturalized by the process of home fructification.



CENTURY.

Originated by Chas. Starr, Avondale, Pa. Disseminated in 1886.

CHAPTER XXV.

THE LIMIT ZONE OF THE SEMPERFLORENS CARNATION—
ISOTHERMAL LINES—CLIMATIC CONDITIONS—EVERY TYPE
OF SPECIES CONFINED TO ITS ISOTHERM—THE CAR-
NATION'S IS FIFTY DEGREES MEAN HEAT.

AN isotherm is a band or belt of the earth's surface, across a continent, along which a definite number of heat units are evolved during the year, which gives the belt a certain annual average temperature. Isotherms are not strait, regular lines. Their courses are changed by large bodies of water, ranges of mountains, and elevations of land above sea levels. On the volcano of Teneriffe there are five successive different zones of heat, each producing a different class of vegetation. An elevation of 1,000 feet above sea level equals one degree north latitude. Every isotherm on earth has its own Flora and Fauna, its modified men and plants. Soil, sunlight, heat and moisture, are the prime features in climate and factors of life. An isotherm is the composite of these elements. No law in geographical botany is better determined than that a mean annual heat is required by each species of plants for their full development, and that they will tolerate but a slight variation in the number of yearly heat units without modifying their nature to conform to conditions which accompany a less or greater number.

It is surprising to how narrow a belt of specific annual heat some species of plants confine themselves. The cotton plant will submit to but 3 degrees of a variation. The sugar cane requires 83 degrees of heat to mature and will submit to but 5 degrees of a change. It is not temporary fluctuations of temperature that affect the fate of plants, but it is the number of heat units in the definite time that rounds their lives into fruition. Some species are more cosmopolitan in their nature, and their lives are normal in broader zones.

The growing zone in the United States for the remountant type of carnations lies between 37 degrees and 43 degrees north latitude. The isotherm indicated on the map has a mean annual temperature of 50 degrees. It is the equator of the empire of *Dianthus Semperflorens*, the meridian of its home and health, its profits and prophecies. It is the only belt of land on earth in which Alegatiere's cross-fertilized product has developed into a carnation that will unfold its petals to an Arctic sun and fling its perfume on the winds of winter. Latitudes and longitudes are imaginary lines on the earth's surface for geographical convenience. Isotherms are lines drawn around the world by the finger of the Almighty along which plants and animals hug congenial conditions. These lines are as stable as the earth's axis and enduring as their Fauna and Flora. It must not be understood that carnations will not grow north or south of the 50-degree isotherm, but if they do, they must modify that specific type of character which gives them esteemed value in that isotherm. Some forms of vegetation reach their greatest perfection when far removed from the latitude of their nativity. The potato has an insignificant bulblet in its native home, but feeds millions on its monstrous tubers in a different latitude. There is a typical isotherm on which every species of vegetation will reach its highest evolvment for the gratification of man.

The 50-degree isotherm has been established by the Agricultural Department of the United States government as far west as the 100-degree of west longitude, by twenty years of accurate experiments; west of that the department informs us the line is not so well established, but is thought to bend rapidly to the north. The line strikes the continent on the Atlantic seaboard near Boston, runs irregularly on the north of the 40 degrees north latitude as far west as Denver and then from mountain ranges and gulf stream inclines suddenly toward the north, striking the Pacific Ocean near Vancouver Islands.

The average altitude of the land on this isotherm above sea level is 1000 feet. It has an annual average rainfall of 40 inches,

75 per cent of relative humidity, 50 per cent of sunshine, 45 degrees of surface and 50 degrees of aerial temperatures.

The greenhouse treatment of carnations equalizes the extremes of the year's temperature but does not materially increase the number of annual heat units. There is always much moisture rapidly passing into vapor in housed carnations and absorbing an immense volume of latent caloric, thus keeping the surface temperature surprisingly low. Moisture and heat are inverse conditions. The thermometer and hygrometer teeters with the temperature: when one goes up the other goes down.

The primitive La Puritie type of carnations by selection, has been surely drifting into a different species, requiring more heat, which supports the assumption that greenhouse methods for carnations has raised their annual mean temperature above that of the natural isotherm. Mrs. Lawson, one of the highest types of the new evolved species, was complained of by a grower to its originator, Mr. Fisher, for bursting its calyxes, and he suggested 55 degrees night heat as the remedy. This is in full harmony with the author's contention of an evolution of a new species of carnation growing out of adaptation by selection and requiring an artificial or natural isotherm of 55 or 60 degrees of annual heat to meet the requirements of its nature.

The 50 degree isotherm leaves all California to the south of its belt. California's isotherm of 60 degrees has a type of carnation of its own, adjusted through forty years from the same parents to meet different climatic conditions and meets the æsthetical tastes of the people of that climate as fully as does the La Puritie type on the isotherm 50 degrees in north latitude.

In 1892-3-4 there were introduced over one hundred fine named varieties of California carnations into the latitude of the *semperflorens* type, and it was proven that their modified type was not adapted immediately to the *semperflorens* zone. Mr. Linton of Piru City, California, says that carnations there are grown *out*; they live for several years, grow best in their wet or winter season, and bloom best in their dry or summer season; they make a bush

three feet high and two feet across; and a plant will blow from 200 to 500 blooms in a season.

Messrs. Hatfield and Tailby made special efforts to acclimatize foreign carnations in the native zone of the semperflorens type and failed. Mr. Hill visited Europe in the interest of this genus of plants and purchased two hundred dollars worth of the most promising kinds to naturalize them in the semperflorens zone and in a short time had nothing to show for his time and expense. Mr. Dorner obtained the finest strain of seed possible from Eufurt, Germany, the storm center of splendid Selfs, Picotees and Bizaros to acclimatize in America, but without success in continuing their habits. Mr. Hancock imported one hundred and thirty varieties from Germany and afforded them the best possible conditions but without good results.

Any of the foregoing types of carnations that possessed the particular inherent nature of distributing their enormous crops of bloom through their mature lives and could be inspired to do so by artificial heat, in a few generations could have been acclimated to the zone of the semperflorens type. Less than forty generations of cross-fertilization and parental selection might have evolved a Lawson out of a raw sulking emigrant possessing these essential qualities which are pathognomonic of the species. No semperflorens carnation ever reached high merit or commercial importance that was not born within the boundary lines on the map. Nature "invokes the curse of Rome" against invaders. The genealogy of Mrs. Joliff is legendary and has never been established. Peter Henderson was bred by Charlton in New York and disseminated by Nanz and Nauner of Louisville, Ky.

Not only carnations but all plants that are transferred to new climatic sections with different mean units of annual heat must be *naturalized* or *acclimated*. Corn raised in Virginia will not ripen in Canada's short season. Canada corn taken to Virginia is six weeks' corn the first season, then lapses to its normal number of heat units. No carnation, though it be of the same Alegatiere origin, primarily inured to conditions in a different latitude ever gave immediate satisfaction when moved on to the 50 degree iso-

therm. This fact is abundantly proven by one hundred carnations that have been imported from Europe and as many from California, very few from either source having appeared on the recommended list the second time. Sievers of California is credited with the origin of Ethel Crocker, but it was not grown from California seed, and Siever's glass treatment of carnations at San Francisco tends to normalize their nature to the requirements of the 50-degree isotherm.

A higher mean annual temperature by greenhouse methods may, if it has not already done so, evolve a new species of carnation adapted to a higher artificial or natural isotherm than 50 degrees. See chapter on a new species of carnation.



A TYPE OF CARNATION WITH SERRATED PETALS.

CHAPTER XXVI.

MAP OF 50 DEGREE ISOTHERM—THE NORMAL CLIMATE OF
CARNATIONS—CREAM OF ALL THE CARNATIONS SINCE
THE BIRTH OF ASTORIA—NAMES, COLORS, PLACE
OF ORIGIN—ORIGINATORS' NAMES.

THERE was an importation of fertilized carnation seed from Lyons, France, in 1858, another in 1862, another and two plants, La Puritie and Edwardsii, in 1864. From the seed of 1862 Astoria originated and is the oldest named carnation, to the manor born, in America. Its origination is credited to Wilson, a neighbor florist of Zeiler, Gard & Co., who imported the seed. It was a yellow-variegated variety of considerable merit, and Wilson named it Astoria after the name of the place he lived, on Long Island. Astoria was born and named two years before La Puritie and Edwardsii were imported. La Puritie was a foreigner though Lyons, France, is on the same isotherm as New York. La Puritie inherited many of the defects of its ancestors but enfolded in its nature mighty floral possibilities and has left a line of beauty trailing down the ages. It was far from being perfect but it was the best nature had evolved; it met the ideal of the time. A right that happenstoo soon is half wrong; perfection reached early is considered half a freak. The map will give the dynasty of royal blood that has come to rule the world of flowers and the boundaries of their empire.

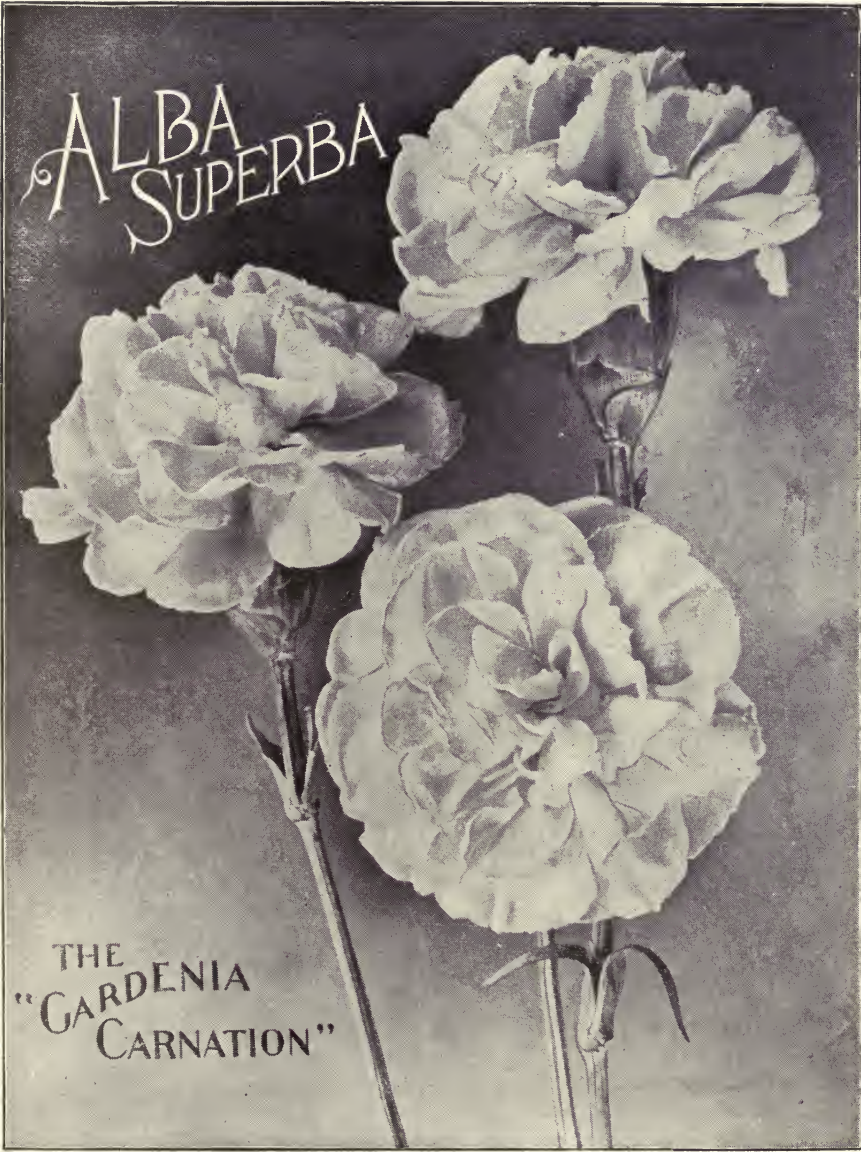
Astoria was the first named carnation born in America from Alegatiere seed cross-fertilized in France and brought over in 1862. Lady Emma was the first carnation born in America from seed cross-fertilized by Charles Starr in 1875. The reader will notice the hiatus in the list of new carnations between the dates of 1875 and 1886. This was the nebulous era of American flori-

culture. There were no trade journals, no concert or organization among the hundred and fifty primitive floral establishments of that period. Carnations were grown from self-fertilized seed obtained from the pods of the progeny of La Puritie, Astora, Miss Joliff and their nameless compeers, and named as fancy suggested. Not more than a dozen florists in the country during this interregnum, meddled with or cared for the new born species of the *Dianthus* genus of plants, and not a new carnation was originated during these eleven years whose name passes on the records possessing merit. Miss Joliff originated at the same time and from the same source as Astoria. Both originated from Alegatiere's seed, though years before La Puritie and Edwardsii were imported. It is singular how regularly the royal line of new and great carnations have kept step with recurring years. There are but few carnations unnamed and outside of the following chronological list that have reached general acceptance.

But the humblest carnation that ever bloomed has been an evangel of the gospel of beauty, and with voiceless colors has brightened twilight gloom in some human heart.

I have incorporated into the select list a number of new carnations of 1901-2, not because their fate is fixed. Their destiny is hurrying forward to the crucial crisis of the people's verdict: their frowns are exile and their smiles are fame. A singular fatality often waits on new carnations that are filled with splendid promises. They become enfeebled by some mysterious marasmus that leaves them an easy prey to bacteriosis or other diseases and they quickly drop out of cultivation. This was the case with Uncle John, The Stuart, Edna Craig, Empress, Sea Gull, Mammoth Pearl, Kerskin and others. Like the *Ephemera*, they lived for but a day, singing a ditty at dawn and a dirge at dusk. Then again some carnation seedlings are unpromising at birth, but born with an inspiring genius that points them steadily to the throne of Flora, as were Wm. Scott, Mrs. Bradt, Daybreak and Buttercup.

In 1896 there were 1000 circulars sent to carnation growers asking them to return votes for and against all the carnations



ALBA
SUPERBA

THE
"GARDENIA
CARNATION"

Originated by John Burton, Chestnut Hill, Phila , Pa. Disseminated in 1897.

they new and grew. There were only fifteen that received a majority of the votes. They were:

Tidal Wave,	Thos Cartledge,	Lizzie McGowen,
Puritan,	Portia,	Grace Wilder,
Sweetbrier,	Orange Blossoms,	Daybreak,
Stewart,	Uncle John,	Buttercup,
Albertina,	Wm. Scott,	Silver Spray.

Some varieties of carnations give eminent satisfaction in certain localities of the carnation zone and are absolute failures in other sections. What growers most admire in a carnation is its cosmopolitanism, such as is possessed in Daybreak, that received but one vote for demerit in the carnation growing world.

The humblest carnation that ever bloomed has been and educator, served its purpose, and filled its mission. La Puritie was as much esteemed in its time as the grandest variety is now.

These *Royal Line* carnations sprang from the loins of the race, and have no particular pedigree, individual line of ancestry or varietal blood. Greatness and genius are not hereditary, or transmissible in either the animal or vegetable kingdom. Great men and great carnations, as a rule, spring from humble parents. Three of the greatest Emperors Rome ever had were followed by the most detestable sons that ever donned the purple.

The subjoined chronological table gives the cream of all the carnations since the birth of Astoria in 1866, that have added lusture to the marvelous pageant of their unfolding grandeur, the date of their origin, the locality that gave them birth, their names, colors, and with whom they originated. Find their local nativity by figures on the zonal map corresponding with those in the first column of the table.

CHRONOLOGICAL LIST OF THE ROYAL LINE OF THE REMONTANT
HOUSE OF DIO ANTHOS.

MAP NO.	Name.	Year.	Where Originated and by Whom.	Color.
	Atim, <i>1st carn'n.</i> Improved.	1844	M. Dalmias, Lyons, France.	
		1856	Alegatiere, Lyons, France.	
I.	1st Seed Imp'ed.	1858	Zeiler, Gard Co., Flatbush, L. I.	Failed.
I	2nd Seed Imp'ed.	1862	" " " " " "	
*	Astoria, <i>seed '62.</i> Two plants and	1863	Wilson, Astoria, L. I.	Yel'-var
I	3rd Seed Im'ped.	1864	Zeiler, Gard Co., Flatbush, L. I.	
I	La Puritie.	1864	" " " " " "	Pink.
I	Edwardsii.	1864	" " " " " "	White.
	Joliff, <i>seed '63.</i>	1864	Unknown, Long Island.	Pink.
2	Lady Emma.	1875	Chas. Starr, Avondale, Pa.	Scarlet.
2	Springfield.	1876	" " " " " "	Pink.
2	Chester Pride.	1877	" " " " " "	Wh'-var
2	Buttercup.	1878	" " " " " "	Yel'-var
I	Pres. DeGraw.	1878	Zeiler, Gard Co. Flatbush, L. I.	White.
3	Henzie's White.	1879	Breitmeyer, Detroit, Mich.	White.
4	P. Henderson.	1880	Carlton, Nyack, N. Y.	White.
5	Grace Wilder.	1881	Tailby, Wellesley, Mass.	Pink.
6	Fascination.	1882	Thorp, Pearl River, N. Y.	White.
6	J. Y. Murkland.	1883	" " " " " "	Scarlet.
6	Portia.	1884	" " " " " "	Scarlet.
7	Anna Webb.	1885	Fisher, Framingham, Mass.	Crimson
8	Ferd. Mangold.	1886	Simmons, Geneva, O.	Crimson
8	Tidal Wave.	1887	" " " " " "	Pink.
9	L. L. Lamborn.	1888	Swayne, Kennett Square, Pa.	White.
8	Silver Spray.	1889	Simmons, Geneva, O.	White.
10	Lizzie M'Gowen.	1890	McGowen, Orange, N. J.	White.
8	Daybreak.	1891	Simmons, Geneva, O.	Pink.
11	Albertina.	1892	Dorner & Son Lafayette, Ind.	Pink.
9	Sweetbrier.	1893	Swayne, Kennett Square, Pa.	Pink.
12	Jubilee.	1894	Hill & Co, Richmond, Ind.	Scarlet.
13	Alaska.	1895	Chitty, Patterson, N. J.	White.
12	Flora Hill.	1896	Hill & Co., Richmond, Ind.	White.
3	Gov. Pingree.	1896	Breitmeyer, Detroit, Mich.	Wh'-var

*Astoria was the first carnation plant grown in America, from seed cross-fertilized in France. Artificial fecundation was not practiced on carnations in America for eleven years, during which period not a carnation is recorded on the roster of merit. Charles Starr was the first to practice the art, and in 1875 turned out the first carnation from seed, artificially fertilized, in America, which has been followed by a swelling tide of grand acquisitions.

MAP NO.	Name.	Year.	Where Originated and by Whom.	Color.
14	Glacier.	1896	Ward, Queens, L. I., N. Y.	White.
11	White Cloud.	1896	Dorner, Lafayette, Ind.	White.
11	Wm. Scott.	1896	" " "	Pink.
15	Bon Ton.	1897	Blake, Rockdale, Mass.	Scarlet.
14	New York.	1897	Ward, Queens, L. I., N. Y.	Crimson
16	Firefly.	1897	Hancock, Grand Haven, Mich	Scarlet.
7	Servia.	1897	S Fisher, Framingham, Mass.	White.
14	Gen. Maceo.	1898	Ward, Queens, L. I., N. Y.	Crimson
11	J. H. Crane.	1898	Dorner & Son, Lafayette, Ind.	Scarlet.
17	The Marquis.	1898	Marquisee, Syracuse, N. Y.	Pink.
18	Irene.	1899	Crabb & Hunter, Grand Rapids	Pink.
19	Elm City.	1899	Kraus, New Haven, Conn.	White.
16	Gold Coin.	1899	Hancock & Son, Grand Haven	Yellow.
20	Geneve Lord.	1900	Weber & Son, Oakland, Md.	Pink.
11	Morning Glory.	1900	Dorner & Son, Lafayette, Ind.	Pink.
14	Mrs. Lawson.	1900	Fisher, Ellis, Mass.	Pink.
14	Ethel Crocker.	1900	Sievers, California.	White.
22	Olympia.	1900	May, Summit, N. J.	Wh'-var
11	Lorna.	1901	Dorner & Son, Lafayette, Ind.	White.
20	Egypt.	1901	Weber & Son, Oakland, Md.	Crimson
20	Norway.	1901	" " " " "	White.
1	Prosperity.	1901	Dailedouze Bros. Flatbush, L. I.	Wh'-var
14	Gov. Roosevelt.	1901	Ward, Queens, L. I., N. Y.	Crimson
21	Queen Louise.	1901	Dillon, Bloomsburg, Pa	White.
23	Estelle.	1901	Witterstaetter, Sedamsville, O.	Scarlet.
25	Mrs. Bird Coler.	1901	Molatsch, Brooklin, N. Y.	Scarlet.
27	Midnight Sun.	1901	Weaver, Bird-in-Hand, Pa.	Crimson
27	Lancaster Pink	1901	" " " "	Pink.
26	Heilig's White.	1902	Heilig, Franklin, Pa.	White.
24	Cressbrook.	1902	Warburton, Fall River, Mass.	Pink.
23	Adonis.	1902	Witterstaetter, Sedamsville, O.	Scarlet.
28	E. A. Nelson.	1902	Indianapolis, Ind.	Pink.

CHAPTER XXVII.

NEW SPECIES OF CARNATION—DISTINCTIVE FEATURES OF
DIANTHUS SUPERBA AND DIANTHUS SEMPERFLORENS
—THEY REQUIRE ESSENTIALLY DIFFERENT
TREATMENT.

FOR fifty years, hundreds of men have been cross-fertilizing the best seedling carnations that have sprung from Alegatiere's origination, and they have obtained a species of carnation as distinct from Alegatiere's as it was from the species that gave it birth. Structural difference is the basis of all Classes, Orders, Genera and Species of the botanies. There is not the wide gape of difference between species as some imagine. Species do not spring into being full panoplied, like Juno from the brain of Jupiter. Darwin says: "varieties are incipient species and require persistent congenial environment to take on the full and stable character of a species." It may be difficult today to draw detailed distinctions between the old and new species of carnations, but time will survey their boundaries and drive the division stakes. A species includes all individual plants that are *alike* in roots, stems, leaves and in floescence. Martyn says that there are as many species of plants as there are invariable structures in plants. If La Puritie and Mrs. Lawson had been found growing wild by Linnæus, the plant wizzard of the world, he would have classed them as different species.

La Puritie and Edwardsii were true specimens of the Semperflorens type of the Alegatiere carnation. Their characters and habits are well remembered by all the oldest florists. They grew from 12 to 15 inches high, bore their stemless two-inch flowers in profusion on small, tough, wiry, procumbently inclined stems. They were cultivated on the dry-side, were small feeders, with web-like anastomosing roots, were immunes to drouth, loved micaceous

and argillaceous soils, recovered quickly and without damage from exhausting dryness, revolted at manure foods, loved only the chemical elements in the soil, were hardy above zero, and florescent at 40 degrees night heat. They were wonderfully productive of bloom, fifty buds and blooms often being counted at a time on good specimens. The relative length of their stamens and pistils indicated a pendulous flower and plant of sprawling habit. Their flowers averaged twenty full petals, were fertile in seeds, beautifully fringed and emitting a strong exhilarating clove fragrance.

Lawson, Roosevelt and Novelty are well defined types of a new species of carnations. I will epitomize some of the distinctive features of Lawson published by its originator in the *Florists' Exchange*.

"Cuttings struck in March are best for early blooming; in April for later blooming. Blooms bleach in the sun, must be shaded early and deepened as season advances; must be kept in a night temperature of 55 degrees to keep from bursting its calyx; cuttings must be carried forward into 4-inch pots, no check permitted to its growth, and should be mulched with pulverized sheep manure every two weeks from November to April."

This evolved type of carnations will grow 4 feet high and support immense flowers 4 inches in diameter on great stiff stems 3 feet long, which have monstrous soft succulent nodes, sparse foliage consisting of broad, thick, fleshy leaves. These plants have large fibrous roots, are gross feeders on humus, demand much water, circulating an immense volume of vegetable blood, and require a night temperature of 55 degrees, which is equal to an annual average of 75 degrees, within 5 degrees of that of the equator; they cannot recover from a drouth. If their growth is arrested their tide of vitality is never fully resumed.

Isotherms are nature's imperious method for differentiating the Flora of the world into Orders, Genera and Species. Forty years of artificial heat in winter has evolved a new species of carnation, modified its esoteric nature to require more moisture, different food, higher heat, a tropical vitality and a larger structure.

By way of resume I present a more condensed argument favoring the assumption that a new species of carnation has originated from the Alegatiere type. Darwin, Huxley, and all authorities worth considering, admit that varieties are the parents of species; that species are the offspring of a single primitive stock, and each is a natural or cultivated variety and may be artificially originated, conformed and established by selection and environments.

"Special Creation" and "Transmutation" are the only two hypotheses respecting the origin of species. One views their origin as arising by a supernatural creative act. The other holds that species are modifications of pre-existing species through purely natural causes.

One of these theories assumes that a species is formed at once and at the moment the male and female elements meet in the ovary. The other, that species are initiated by varieties, and by natural or artificial selection and by physical environments gradually moulded into a separate class. And that classes or species are known as being separate by morphology (structures), or physiology (vitalities), or by both structure and vitality, and that these constitute the boundary line between species.

For forty years, selection has been practiced with the species of carnations of the La Puritie type, originated with Alegatiere and conditioned with new environment, and a new species of carnation is the resultant.

Its morphological boundary lies between a procumbent plant with a two-inch stemless pendent flower and an erect plant with a four-inch flower on a three-foot stem. Its physiological boundary lies between a plant whose nature is on the arid side of culture, requiring little manurial nutriments and yielding its florescence in a 45 degrees temperature; and a plant requiring 55 degrees of heat to afford its bloom, requiring much moisture and manurial foods, impatient of all aridness, and circulating a great volume of vegetable blood. Either the morphological or physiological difference constitutes, according to authority, enough of a divergence to install a new species.

Dianthus superba embraces both structural and vital difference from *Dianthus semperflorens*. A new species is not permanent unless the conditions are persistent through which it was evolved. Humanity gravitates towards the gutter which civilizing forces must ever antagonize. An evolved species of the vegetable kingdom is ever gravitating towards ancestral types unless counterpoised by selection and culture. Accept or reject the assumption of a new species of carnations, the fact remains, a different treatment is already recognized for a carnation blowing a 4-inch corolla on a 3-foot stem and one blooming a 2-inch flower without a stem. Nature asserts with the majesty of command, a different culture for the two varieties, which would not occur if there were not a different vitality to culture. The cultivation of neither kind will ever be abandoned. They fill different niches in the Temple of Flora, but for scientific and commercial purposes the two species should not be confounded. At present a line, though tortuous and vague, would be: plants producing flowers *under* 3 inches in diameter retain their present name, *Dianthus semperflorens*; and plants producing flowers 3 inches and *over*, normally receive the name, *Dianthus superba*.

This would recognize a botanical fact, make market reports intelligent, set the pace for prices, suggest cultural treatment, classify excellence and dignify the new origination with the assumption of an appropriate name, hallowed with antiquity and sanctioned by the centuries.

There were 36 new varieties of carnations registered and introduced or disseminated in 1901. Giving the originator's description: six of these will blow 4-inch flowers; 20 bear flowers 3 inches and under; the calyxes of ten never burst. This list is composed of 17 pink, 10 white, 5 scarlet, 2 yellow-variegated, 1 white-variegated and 1 crimson. Of these, 7 originated in New York, 7 in Pennsylvania, 4 in Illinois, 4 in Rhode Island, 4 in Massachusetts, 4 in Indiana, 2 in Maryland, 2 in California, 1 in New Jersey and 1 in Ohio. More new carnations have originated in Pennsylvania than in any other state; nearly one hundred varieties came from the vicinity of Kennett Square. None of this

list were birthed outside of the carnation zone, nor has there ever been any other valuable commercial carnations. As to the two California introductions, see the chapters bearing on their nature.



The above engraving is a group of three carnations, Edwardsii, white, red and variegated La Purities. It was obtained by the late Charles Starr, and is the first engraving made from the Alegatiere remontant type in this country, possibly in the world. It was engraved about 1880, and has been in the writer's possession fifteen years. Without accurate data as to the time it was made, or the scale of size on which it was wrought, the inference is safe that it dates back toward the era that carnations began to be esteemed and cultivated in America. The cut represents flowers

two-thirds their natural size. The critical observer will notice the long quill-like calyxes and the necessarily long claws of the petals, lifting them well out of the cup before they broaden to burst the calyx. This cut represents, as no description can, the early true type of "*Dianthus Semperflorens*."

On the opposite page is a cut of "Sea Gull," (Furnished by the courtesy of E. G. Hill) and is the exact size of this phenomenal product. It won the Silver Flagon prize over McGowen at the Madison Square Exhibition in New York in the fall of 1891. It became possessed by some occult devil and was never generally disseminated, yet it was the herald of a "New Species," a spectacular prophecy of the genus "*Dianthus Superba*," which is now history.



SEA GULL.

CHAPTER XXVIII.

THE NEMESIS OF CARNATIONS—CAUSE OF THEIR FLOWERS
“GOING TO SLEEP”—CAUSE OF THEIR CALYXES BURST-
ING—RUST A CONSTITUTIONAL DISEASE—STIGMO-
NOSE VS. BACTERIOSIS.

AN ideal carnation for pots would materially differ from those grown on benches for commercial flowers. It would have a compact base, canes of moderate length, given to a profusion of average size crown and terminal flowers on short stems.



The susceptible nature of carnations to the modifying influence of the florists' art by parental selection and cross-pollenization could doubtless in a few years obtain this type and overcome the plant's dislike of root restraint in pots and develop a variety that

might be immensely popular as pot plants. The change required would be chiefly structural, which features are most easily obtained by cross breeding. Carnationists who remember "Snowden" will see in its form and habit a typical carnation pot plant.

Carnations propagated by cuttings in August carried through winter in cold frames and planted out in early spring will bloom from June until heavy frost.

Æsthetics would not have a carnation over three and a half to four inches in diameter, on a stem stiff as a pike pole, nor with petals quilled and formal as a dahlia; such qualities would rob the flower of all its artistic grace.

The calyxes of carnations are being increased in capacity; their fibrous structure is more compact and of slower change than the vascular petals. If adaption by selection had directed itself to longer claws for the petals there would be fewer ruptured calyxes today.

Nature carries relics of all its progressive achievement in the nature and anatomy of every evolving species of plants and animals. In the physiology and structures of every variety of carnations there are vestigial homologues and heredities of every progressive level the species has reached since Theophrastus exclaimed, *Dio Anthos!* Among a thousand seedlings seventy-five per cent will be reversals to some of these abandoned levels.

There is but one way that carnations can be successfully and satisfactorily grown by the people. It is to procure September struck plants from a carnation grower early in the spring; plant them in the lawn as taste suggests; neatly stake them and they will afford a profusion of boutonnières and flowers until heavy frosts, and be as decorative and cheap as geraniums. Pages that have been written on the *popular* cultivation of the carnation are condensed in the above *ex-cathedra* epigram.

Mrs. Fisher and Mrs. McGowen are the best tested out-door summer bloomers.

Thomas Dale of Canada, a competent judge, says Canada cannot produce carnations equal to those grown in the States.

Mature carnation plants are not hardy in the temperate zone, while their seedlings are, which shows how easily cultivated strains of vegetation return to their normal type.

Large carnation flowers are obtained at the expense of many smaller ones. Nature is economical. When it is extravagant in one direction it always economizes in another.

Dark pink carnations and those with solid colors have the best constitutions, and are more florescent and cosmopolitan in their habits, than the shaded and variegated kinds.

Quality in carnation flowers is the demand of its admirers, and the slogan of successful growers. Fame and fortunes of culturists have been built on "quality." Perseverence and close attention to details in growing is the evangel of success and quality.

The American continent has not yet given mankind as great a variety of food and flowers as some others, but in it originated the great food staple of Indian corn, and the potato. It has developed in *Dianthus Superba*, the loftiest symbol of poetry and the potato the most substantial prose of life.

The great commercial and vital differences between pinks with their marvelous *single* crops of multitudinous flowers, in July and August, and carnations, are: the immense short-lived crop of bloom with pinks is evenly distributed through the life of carnations from October to July and the latter kindly respond to the sorcery of artificial heat, which is death to pinks.

In 1880 there was but one floral establishment in America; in 1820, 4; 1830, 11; 1840, 36; 1850, 76; 1860, 112. In 1900, 10,000 that rise to a high grade of commercial dignity, or fully 15,000 all considered.

The production of infertile carnation flowers is but a phase of plant foliation. The foliage is the type, the petals in the corolla are the antitype of the foliage, as is the spathe of the antitype of that plant's leaf.

It has been discovered that sulphur, and possibly other cheap chemicals are often mixed with bales of tobacco stems to preserve their fresh appearance; burning such stems is injurious to plants and ruinous to flowers.

The secretary of the Agricultural Department estimates that there are \$12,500,000 worth of flowers sold each year in the United States, and one-third of this vast sum is realized from the sale of more than 100,000,000 carnation blooms.

There never has been a rust-proof carnation. Those specimens that have been esteemed so, were merely plants, or batches, that by accident escaped Thrips, Red Spider, Greenfly and other puncturing pests to lesion their epidermis, with culture spot in which the spores of rust could vegetate.

The *cause* of carnations *going to sleep* at early and unusual hours has been a source of much perplexity. Carnation petals are vascular and sensitively organized. Their mission is brief and to dazzle by glare. They begin to wilt the instant fertilization is effected. Many gases are quickly poisonous to them; they soon perish if cut before they mature; they shrivel in a dry atmosphere if developed in a wet one; they die if taken from an ice refrigerator into the warm sun. Grown in normal conditions, cut at the proper time, and kept in congenial environments, carnation flowers may be merchantable for nearly three weeks.

Every grower, who buys a new carnation, buys a new character that imperiously demands conditions and yields none.

At the last meet of the Peripatetic Club of Dianthic Oratory, the *fleur de lis* of Ellis won its own gold medal. An unnamed inmate of Cottage Garden carried back to the jewel box the "Holy Grail" from whence it came. The pro-nomen of Hector of San Juan Hill, and Colorado coyotes won easy honors for the fame of Queens.

A good commercial solid yellow carnation has never yet been introduced. They have been so unprofitable that many growers do not cultivate them, but use some of the yellow-variegated kinds as a substitute. In fact, a pure yellow carnation has several unmistakable features of a divergent species.

The commerce during the fall of field-grown carnation plants is very great. They are safely and conveniently shipped any distance by wrapping their roots with what earth that may adhere, in moist moss and setting them erect in a box half the height of the plants and protecting the tops by an open frame nailed to the box. The plants should be *moderately* close. If *crowded* and long confined they will heat and suffer damage.

Since Chas. Starr, hardy pinks have had an enthusiastic champion in C. Eisele of Philadelphia. Mr. Eisele has crossed the remontant carnation with the Marguerites and produced some magnificent hybrids, Jupiter, light pink; Murcury, scarlet; Minerva, deep pink; Neptune, magenta violet; Saturn, crimson; Uranus, maroon; Venus, white; Vulcan, red; and a number of others. Mr. Eisele is also noted for his success in blooming the remontant carnation during summer months. His system consists in striking cuttings the first of October, carrying them in three-inch pots, in a dry bottom cold frame through the winter, and transplanting in the open, as soon as frost is out of the ground. They begin to bloom the first of July and continue until late in the fall.

There is a tireless strain for *large* carnations with *stiff* stems. There is an æsthetic meridian for size somewhere between a species of carnation called *micro petalon*, because it requires a microscope to see its petals, and a corolla the size of a sunflower. Good taste draws the line on a three-inch flower on a stem pendant with grace.

In this work, the treatment of the La Puritie type of carnation is chiefly considered. The habits and culture of a new evolving type of carnation are quite different. The mean annual temperature required by the two species are essentially unlike. Isotherms are nature's sovereign methods for diversifying species.

It is hard to settle the outlines of a perfect carnation flower. There is an enduring contour of beauty if quixotic taste could reach it. That the centre of the flower should be well built up, approaching a hemisphere with petals moderately fringed and standing at right angles with the stem, seems to meet the present requirement of taste and grace.

The following scale of points in a carnation flower has been discussed by some men interested in carnations. It is immaterial whether their standard of comparison is *real* or *ideal*. The significance of the scale resides in the relative importance of the structural features of a carnation's corolla, not in the opinion of a few or their aspirations for the beautiful according to their procrustean standard.

Color.....	25
Size.....	20
Calyx.....	5
Stem.....	20
Substance.....	10
Form.....	15
Fragrance.....	5
<hr/>	
Total.....	100

Mr. Hill, after his tour of inspecting carnations in Europe, says: "They know but little about blooming carnations in England; as far as I could learn it was only practiced by a few amateur florists and from the American standpoint was anything but a success."

It is of interest to those possessing, or proposing the possession of an area of glass for growing carnations, to know of the Florists' Hail Association. The details of this insurance organization has been under the secretaryship of Mr. Esler since it was started in 1888, which is strong testimony of his efficiency. One of his reports shows the growth and favor with which it is received.

Year.	Glass Insured.	Reserve Fund.
1888.. .. .	811,951 Square feet	\$ 491.23
1889.....	1,327,240 "	743.07
1890.....	2,132,118 "	1,322.46
1891.....	3,104,583 "	1,855.84
1892.....	4,078,725 "	2,542.13
1893.....	4,830,780 "	3,107.12
1894.....	6,653,695 "	3,639.55
1895.....	7,489,312 "	4,094.39
1896.....	8,003,820 "	4,621.77
1897.....	10,097,209 "	5,215.26
1898.....	10,189,097 "	5,862.48
1899.....	11,209,865 "	6,649.25

Secretary I. C. Esler, of the Association says: "On the 1st day of August, 1901, it had 1020 members, insured 14,541,382 square feet of glass; paid \$5,328 55 for losses during the year; total receipts for the year, \$10,660 30; and had on hand at the end of the fiscal year, \$8,759.95 available as an emergency fund.

Glass belonging to members of the Association to the extent of 70,390 feet was broken during the year ending Aug. 1, 1901; and since its organization in June 1887, it has paid 510 losses, involving all expenditures, of over \$45,000. Of 82 losses by hail in 1900-1, all but 19 were in the months of June and July.

The edges of the petals of carnation flower leaves may be serrated, indented, fringed or plain, or possess all degrees of serrulations from a deeply cut, coarse fringe to a simple undecorated border.

Mrs. E. A. Nelson, on page 79, and Alba Superba, on page 133, are fairly good specimens of the last two types. The cuts on the adjoining page represent the serrated and indented classes of leaves. These varied adornments of the rims of carnation petals are the result of the conflicting play of hereditary forces. The ancestors of carnations were noted for their petals being deeply cut and fantastically fimbriated.

B. T. Galoway, United States Department of Agriculture, with census data of 1900 before him, estimates the area of greenhouse glass in America at 30,000,000 square feet, (the type, by mistake, in a former page says 300,000,000), the number of commercial floral establishments at 10,000, exclusive of thousands of small glass structures in which artificial heat is employed. He epitomises deductions from the above as follows:

"The estimated value of the establishments in this country, including houses, boilers, and all fixtures, is placed at 50 cents for each square foot of glass, or \$11,250,000 in all. The income of the producer will average 50 cents per square foot annually, or \$11,250,000, and double that amount when viewed from the standpoint of the retailer. Considering the amount from the retailer's standpoint, therefore, the total value of the annual output is \$22,500,000 or \$1 for each square foot of glass.

"It is estimated that the retail value of cut flowers sold annually is \$12,500,000, the estimated apportionment of the sum being, for—

Roses.....	\$6,000,000
Carnations	4,000,000
Violets.....	750,000
Chrysanthemums.....	500,000
Miscellaneous flowers, including lilies, etc.....	1,250,000

"Estimating the average retail value of roses, carnations and violets at \$6, \$4 and \$1 per hundred, respectively, the total num-

ber of each sold annually, based on the above values, would be, of—

Roses.	100,000,000
Carnations.....	100,000,000
Violets.....	75,000,000
Total.....	275,000,000

“The retail value of the plants sold is placed at \$10,000,000. Taking the plant trade as a whole and the country in the aggregate, the average-sized pot used is estimated to be 3 inches, and the average retail price 10 cents per pot. This means that there are no less than 100,000,000 plants sold every year.

To handle this business in its entirety requires probably an average of not less than one man for every 1,500 square feet of glass, or 20,000 men.

“My carnations burst more than usual. What’s the matter?” The calyxes of carnations are a fibrous fabric, easily torn lengthwise and are developed before the petals, which are vascular and of rapid growth, requiring an active circulation and the stimulus of heat and light to lengthen their claws and lift them out of their calyxes formed of fibers, feebly joined, and easily ruptured.

Nothing will dignify the floral profession more than a general knowledge of botany. Every man that aspires to be a florist should understand the general history of the plants he grows, their anatomy, physiology and pathology. Florists need not be botanists in the technical sense of the term. If they were, they would likely not be practical florists. The florist deals in æsthetics, his stock in trade are the “Smiles of Nature,” his humble vocation keeps him sordid, he is compelled to rake muck piles for grains of gold, and to measure a good carnation by the amount of money it can make him.

Some varieties of carnations produce flowers with thin and feebly organized petals which soon wilt after they are cut. There has been no system devised to scale the keeping qualities of a carnations bloom, nor does this feature in new carnations enter into the roster of their many alleged vices or virtues.

The greatest draft on the life forces of carnation plants is at their blooming period. They are then crystallizing precious protein compounds in their seeds, as food for embryonic plants. It is then they need nourishing and easily assimilated plant food.

The petals of a carnation flower may be shaded, flaked, penciled, or dotted. They may have plain borders or be notched, serrated or fringed. These forms and conditions are differentiations of the ancestral types, modified by hereditary influence.

The first flowers of some seedlings have unruptured and perfect calyxes; after that they may uniformly burst. This peculiarity extends to the first, second and third generations of the life of the same variety. The structural indices of a non-bursting carnation flower lie in the length of the claws which lift the petals out of the calyx before they broaden and mature.

There is a renewed effort to grow American carnations in the foggy climate of old England. The following carnations of American origin are now offered by English growers; G. H. Crane, Maud Adams, Melba, Flora Hill, Triumph, Bridesmaid, Day-break, Victor, Mrs. McGowen, Bon Ton, Evelina, Lily Dean, Mayor Pingree, Mrs. James Dean, Painted Lady, Empress, Mrs. Geo. M. Bradt and White Cloud. The favorites so far appear to be Flora Hill and White Cloud.

It would be anomalous for a broad petal to be transposed from the leaf of a La Puritie carnation one-sixteenth of an inch wide; but not strange, as has been noticed, for petals one-and-a-half inches wide to be the antitype of leaves on the same plant one-half inch across, and the law of proportion carried out in the size of the plant and its corolla. There never will be four-inch carnation flowers on Alegatiere's La Puritie species until nature plays a vaudeville with species and the law of proportion.

Small carnation plants from the field, carried in 5-inch pots in a good cold frame through the winter, make magnificent blooming pot plants for spring sales.

Carnation cuttings should be inserted in the sand deep enough and made sufficiently firm to enable them to maintain vigorously a vertical position.

Whither conditions favoring the best production of bloom in carnation plants are the ones that afford the best cuttings is a question of some uncertainty. I think the temperature too high and the nutrient *stimuli* too great to yield a first class cutting from the true *semperflorens* type of carnation plants, probably not for its new and cognate species. But plants conditioned to produce bloom are now accepted as proper to afford cuttings and their yield is made secondary to the crop of flowers.

The profits of growing carnation flowers depend on the management of the plants and the market to be reached. It is safe to estimate that carnation plants, through the season, will average twenty flowers each; ten square feet of glass will cover one hundred plants, including alleys. The price of the flowers through the season will average, in any market, ten dollars per thousand. High grade fancy flowers, in affluent markets, have commanded from sixty to one hundred dollars per thousand.

"*Practical Floriculture*," published in 1868, states that colored carnations sold in the New York market then for twenty dollars per thousand and whites for forty dollars. The flowers then produced were without stems and ranged from one to two inches in diameter. The excellent trade papers now published, with the daily price circulars from wholesale dealers, keep the producers in constant touch with the reigning prices of carnation flowers. The season, quality, and market, control the price of the carnation grower's product.

It is an irrevocable law of nature, and demonstrated by experience, that it requires a definite number of units of heat, light and moisture for any vegetable organism to reach maturity, and round the object of its existence. One great desire of carnation growers is to obtain carnation flowers earlier in the season than the plants have commonly afforded them. If the above is a sound law in vegetable physiology, does it not contain a solution of the problem of early carnation flowers? How is it possible for a carnation starting its life in February or March, and carried on any lines approximating the nature of the plant, to receive the number of units of heat and light that nature could afford it during its vegetative season between March and November?

The flowering, or *reproductive*, period of its life is well understood. It is its *vegetative* era that embodies the rebus for early flowers. Growing carnations under glass, with greater or less success, is a supremely abnormal and artificial method. If the carnation's life was started in August or September and carried healthfully forward with approximately normal environments, would it not have time to husband the units required for the puberty of its *vegetative* life, and start with flowers correspondingly earlier on its *reproductive* era? If it would not, the assumed law is at fault, for nature makes no mistakes. If the law is sound, a matured biennial carnation plant could be benched the first of July, ready to start on its lyric of life begetments of which flowers are the poem and embryos in seed the appendix.

A *ripened* carnation plant is one that has finished the first season's growth, elaborated its juices, crystalized and deposited in its medulla and the interstices of its tissues the protein compounds to sustain a coming life fraught with the loftiest purpose of it being. The desire and destiny with man is to live beyond the grave. The object and purpose of a plant is to survive beyond its limit of life, in embryonic seeds.

The puberty of a biennial carnation plant is the somnolent period, the coma of winter's cold, the change in its vital functions from *vegetative* to *reproductive* forces, between *existing* and *persist-*

ing, between the *yesterday* and the *tomorrow* of life. (It is then a *ripened* plant. All fruits are but ripened pistils.)

The stems of the plant are then firm and compact; its nodes are solid, almost woody; leaves tough and leathery; stems erect, circulating but little sap; it has stopped growing and is fortifying for the swoon of winter. It should then be lifted and benched, it matters not if the soil is dust, without a particle of dirt to the roots; the thermometer 90 degrees in the shade, with a little moisture the plant will scarcely flag. It has then rounded the first epoch of its life, vitality is torpid, heretofore it has lived to grow, hereafter it will live to *persist*. The same conditions apply to all biennials.

This fact crystallizes in itself all nebulous theories and experiences of carnation growers about early and late lifting, in warm or cool, in wet or dry weather. The principle is as inexorable as the law of nature governing biennial life.

There has existed in America about 1000 named carnations since the first were introduced in 1864; about 200 of this number have been importations from Europe and California. It is senseless history to cumber records with the names of worthless and extinct carnations.

There are two financial features in growing carnations. One is for the production of their bloom, the other is for the "pips" and rooted cuttings the crop may afford. Most growers combine both features, and all growers endeavor to root enough cuttings to supply their own demand for plants.

There are statements in an old work called "*Flori Historica*," published in 1829, that carnations then had perfect calyxes, long stems, and bore three and a half-inch flowers. They must have been a different carnation from the species now known by that name, for the kind in cultivation now did not originate until thirty years after that work was printed.

Syringing with bordeaux mixture discolors the foliage of carnations.

To understand the physiology of a carnation's life is to stand on the ultimate in growing it.

Carnations are being bred toward strong canes and away from fragrance and productiveness of bloom.

Cultivate carnations in the field after each rain and between rains. Cultivation is a substitute for rain.

Scrupulous cleanliness and close attention to all the details in growing carnation will make success a certainty.

A carnation grower, with the description given of the diseases in Chapter XX, and a dollar and a half microscope, can easily determine the character of any trouble that affects his plants.

Every carnation grower should have hygrometers, and thermometers in his houses, and a microscope in his pocket. These instruments ring the bells when the Red Spider, frigidity, and disease knock at the door.

The best varieties of carnations (*Dianthus Semperflorens*) is the loftiest evolution of the little five-petaled pink, mentioned by Theophrastus two thousand years ago. Its main development has been in the last fifty years. The science of botany demonstrated the practicability of artificial hybridization, and cross-fertilization, by which the carnation in the last forty years has reached an evolvment that the slow and uncertain processes of nature would not have accomplished in as many centuries.

The Wisconsin College of Agriculture has experimented on watering plants with water at 32 degrees and 75 degrees Fahr. and finds no perceptible difference in the effect on the plants, whether they were in or out of doors.

The statement is made with some assurance that out of 4720 kinds of flowers in Europe only 420 have pleasant odors. Perfume differs with different persons, and fragrance was not originated to please the olfactories of man as much as this sense in insects.

The perpetual type of carnation differs from its parental border species by continually remounting itself with flowers in response to the *stimuli* of artificial heat, but will not produce more flowers during eight months of its flowering period than its ancestors did, and does, in six or eight weeks. The carnation merely trails glory through a longer duration and through a period of the year in which flowers are more appreciated.

Sterilizing the soil on greenhouse benches is now claiming considerable attention. The Massachusetts Experiment Station has devised a system of pipes under the benches through which steam can be turned and a heat of 200 degrees quickly obtained in the soil. It is claimed that highly heated soil produces better crops, converts elements in the soil into plant food, besides destroying latent eggs, worms, pupus, spores and germs of the nematodes.

There are many instances when benched carnations need an antidote for pests when cloudy damp weather would forbid its application in liquid form. "Hammond's Slug Shot" can be used as a dry powder, and spread over plants with a dry duster or blower, and is found effective. This composite powder can also be applied in liquid form, through a sprayer or pump. It is obtained from seedmen throughout the States, put up in perforated screw-top canisters for convenient and immediate use.



HEILIG'S WHITE.

This carnation originated with P. Heilig of Franklin, Pa., in 1899, and is not yet disseminated.

If it were not for usurping the prophetic functions of Isaiah, I would name a carnation destined to sound a note on the keyboard of progress that has not yet been heard, but prophecy is always doubtful until it becomes history.

Mutilation by disbudding is not a factor in evolving carnation flowers with longer stems. Emasculation is not transmissible. No feature in carnations has developed more rapidly than the length of the flower stems. It ranges in 40 years from a flower without a stem to one on a three-foot stem. The drawing nature of glass has powerfully abetted selection in evolving this feature.

The calyx is the outer series or whorl of floral leaves. Organology has failed to discover the true functions for either the calyx or petals of a flower. The calyx is not an essential part of a flower. In poppies and mayapples it falls off when the flower begins to open, and is entirely absent in the lily, tulip, and flowers of many forest trees.

Since the introduction and cultivation of carnations in America the calyx part of its flowering mechanism has been very defective. The joined edges of its sepals have been disproportionately weak and ruptured from the pressure of the petals within; the petals falling down between the torn edges, destroying all the beauty and value of the flower. It is thought that a disproportionate amount of moisture adds to the turgescence of the petals and aggravates the lesion, while ventilation and sunshine strengthen the sutures of the sepals and lessen the difficulty.

Beyond these two insufficient therapeutic suggestions no remedy has been discovered, or scientific cause assigned for carnations rupturing their calyces. If all artificial aid was withdrawn from carnations, as they now exist, a cataclysm of extinction would immediately follow. All that would soon remain would be a five-petaled pink. The first step in their devolution would be a reduction of the number of their petals and the restor-

ation of more vigorous organs of reproduction. The comparatively monstrous calyx which has been slowly developing for forty years would be the last to follow in the wake of their degradation, as it was the last to emerge and conform to an enlarged corolla. Nature's supreme concern is the continued life of a species. If one mode, or process of life continuance is lost, nature instinctively substitutes some other mode for self continuance.

Carnations are a horticultural form of the primitive *Dianthus Caryophyllus*. Their flowers are sterilized by the artificial multiplication of their petals. Nature facilitates their continuance by dis-articulations, or easily rooted cuttings. This process was deemed impossible before Alegatiere's time and is not yet practiced in Europe.

There is a pseudomorphous unlining of the inner series or whorls of floral leaves. The multiplication of the petals is at the expense of the fertile stamens and pistils. This modification obtained by selective breeding has not so easily affected the calyx or outer whorl. The calyx was not quickly involved in the evolutionary line taken by other parts of the carnation flower. It made a slower deflection from its primal type.

The natural and primitive capacity of a tubular carnation calyx was to hold only the long slender claws of five petals. Artificial development of the flower demanded of it a capacity to hold the broad fleshy leaves, and short thick claws of fifty petals. As an organ the calyx was not in the evolutionary swim with other parts of the flower. The calyx did not keep synchronal step with the unfoldment of the petals.

This disproportionate development of the different whorls of floral leaves is not unusual in flowers. The sepals are augmented in the ranunculus; stamens in the cactus; and the pistils in the wild buttercup, and the petals in the carnations. Carnations' calyces rupture at the seam of union between the sepals. The leaf is a primal organ of a plant, the sepals of the calyx are slightly modified leaves of the plant, retaining the texture, chlorophyl, etc., of the true leaf, hence a greater resistance to change, a

more stable anchorage to the type of this primal organ of plant-life than that possessed by the *pseudo-morphous* petals.

The structure of the petals of a flower is frail and degenerate, their function is not known, they are not an essential feature of a flower's purpose. It is not strange that such tissues in a flower should be the first and fastest to yield to the blandishments of high culture. Herein resides the cause of ruptured calyxes in carnations. The only radical cure for it is to breed poly-petalous corollas back toward their five-petaled ancestors, or breed the capacity of the calyxes forward for a fifty petaled corolla. The first will not be done, the last is being done.

Nature stopped creative acts in the organic world long ago. All her efforts are now directed to modifying organs to meet new requirements. Nature never creates new organs, but modifies old ones. The process of change has been for forty years, slowly modifying a tubular calyx into a bell-shaped calyx in carnations, to meet requirements, without bursting, a plethoric corolla, which long antedated the requirement. This result is nearly accomplished, half the introductions of 1900 and 1901 showing the bell-shaped type of calyxes already attained. A decade back, it could not be said that a single variety of carnations was exempt from ruinous ruptures. Now it can be said many kinds are not troubled with objectionable lesions, and a few are absolutely free from the fault.

Prof. Authur called the rust disease, "*Bacterium Dianthi*," or Bacteriosis. Bacteriosis implies a disease of carnations caused by bacteria. Prof. Woods insists that the "Rust disease" is not caused by bacteria, but by the punctures of aphides and other sap sucking insects. Therefore, the term "Bacteriosis" is not expressive of facts and should be substituted by the term "Stigmomose," meaning a disease caused by punctures or piercings.

From my point of view the argument is with Woods, rather than Authur, neither of whom fully embraces the whole boundaries of the rust trouble. Be the germ of *Uromyces caryophyllus* a bacterium or a fungus, whether it enters the structure of the car-

nation plant through its stomas, or through insect piercings, it quickly ceases to be a local and becomes a constitutional disease. If mosquitoes distribute the germs of yellow fever, aphides can carry and inoculate plants with the germs of rust. Whether they do or do not, it is patent to observing carnation growers that their vaccinating punctures are followed with the pathology of "Rust." Rust is no more a local disease than is scrofula. The animal may have a scrofulous diathesis, the plant a rust diathesis. A scrofulous gland may be cut out or a joint amputated, and it in nowise disturbs the constitutional disease. Diseased leaves on a rust plant may be picked off as fast as they appear, and it in nowise affects the fatal progress of the disease after it becomes constitutional.

The rapidity with which this micro-organism multiplies itself is shown by the following extract from bulletin 59 of the A. E. Station, Purdue University.

"We may conclude from these observations that under good conditions for growth an individual of *Bacterium Dianthi* may become two within a half hour, and these two increase to four in the second half hour, and so on. At this rate there would be sixteen at the end of two hours, sixty-four at the end of three hours, 256 at the end of four hours, over sixteen million at the end of twelve hours and over 280 billions at the end of one day. Is it any wonder that a few germs placed in a test tube culture will make it turbid within twenty-four hours? Although the individual bacteria are very minute, requiring 1500 of them placed side by side to extend the sixteenth of an inch, yet the 280 billions that may be formed from one germ within a day represent no insignificant bulk. They would in fact occupy fully a cubic inch of space. As it takes the material of three or four fluid cultures to fill a cubic inch, it is evident that even under the favorable condition of artificial cultivation the food supply soon becomes inadequate to keep up a maximum rate of growth."

THE PRINCIPLE BOTANICAL PARTS OF A CARNATION FLOWER CONSIST OF A

Peduncle.—Stem that supports the flower.

Receptacle.—Upper end of the peduncle.

Calyx.—The outer covering of the flower.

Bract.—Support around the base of the calyx.

Corolla.—The inner part of a flower, composed of petals.

Petal.—Leaf of the blossom.

Stamen.—Male organ in center of the blossom.

Anther.—The enlarged end of the stamen, containing the pollen.

Pollen.—The fertilizing dust on the anther.

Filament.—The stem of the stamen.

Pistil.—Female organ in the center of the blossom.

Stigma.—Enlarged end of the pistil which receives the pollen.

Style.—The cylindrical portion of the pistil of a plant.

Ovary.—The vessel that contains the unripe seed.

Pericarp.—The ripened ovary of a plant.

Valves.—Parts or sections of the pericarp.

Seed.—Rudiments of a new plant.

CHAPTER XXIX.

POPULAR CULTIVATION OF CARNATION—CARNATIONS GROWN AT HOME FOR BOUTONNIERES, LAWN ADORN- MENTS AND TABLE DECORATIONS.

THERE are many who find recreation and delight in growing their own flowers, who possess ample means to purchase them. There is something strangely fascinating in a dormant seed bursting into green life under the skill of our own fingers and in continuing that life through the marvelous media of cuttings manipulated by our own judgment. It is a seance with the occult in nature and a manifestations of her mysterious laws governing life.

It is for those who love and practice floriculture for its inherent witchery and their own amusement that I write this chapter.

The carnation pink is the most popular flower now grown, not excepting the rose.

It is quite a mistake to think that carnations can only be successfully grown in greenhouses. In fact, they are not, strictly a greenhouse plant. The species is a native of cold climates, and its best health is maintained in a low temperature. It is a biennial and when lifted on greenhouse benches responds readily to heat and serves out its second year's existence in winter blooming.

This is the reason it is so popular with florists. Hundreds of acres of glass are now devoted to its cultivation in America.

The carnation is hardy at any temperature above zero. It flourishes in a wide range of temperature, but draws the line of growth at eighty degrees as quickly as it does at forty degrees of heat. The carnation plant is far healthier than the rose and is not nearly as capricious in its habits.

The rose is a perennial plant, a carnation is a biennial; and the greatest cause of failure in growing the latter is in not recognizing this fact. After a carnation has served its two seasons of life it is absolutely useless and should be at once discarded.

People who will not regard this point in the nature of the carnation carry along a half alive plant only for it to end in the absolute death of the plant. Then they will decry their ill-luck.

There is no dispute as to the desire of the people for this artistic flower. It embraces all colors—crimson, scarlet, pink, white and yellow and their various shades. It has an exhilarating clove fragrance, unequaled by any other flower. It has unrivalled symmetry, beauty, and is one of the most lasting flowers that is grown.

For winter bloom if plants must be kept in residences, you can not expect to be as successful as if they were kept in a greenhouse.

The unfavorable conditions of the sitting room for carnation plants are the dry atmosphere and deficient light. Persons who have bay-widows may, to some extent, modify these conditions and those who possess the luxury of an adjoining conservatory can do so still more fully.

Independent of house culture there are thousands of people who would be satisfied with carnation growing, if they could raise these "smiles of nature" from the middle of June until long after the first moderate frosts. This is as easily done as it is to raise any other flower of merit.

There are no plants of as easy culture or that yield as much pleasure for the labor bestowed on them.

There are but few persons who do not love flowers, and who do not love to decorate their homes by growing them and would like to grow carnations instinct with life and fragrant with the spices of the south-land among them if it were possible.

It is not only possible, but easily attainable, if a few simple rules are observed. Every one attempting to grow carnations must remember they are biennials, that it is their nature to live

but two seasons, interrupted by a winter season of rest, after which their usefulness is gone.

I now suppose we are going to grow a few carnations for self-gratification and home adornment. A supply must be obtained, and there are only two ways to do so; one to buy a package of carnation seeds and germinate them. This is not practical. The seed is expensive whether home-grown or imported. A good variety will cost fifty cents a package, or about a penny a seed. The germination of these seeds is difficult under such conditions as exist about a cottage home. The plants at first are delicate and easily destroyed, and it takes all of the first season, if you are successful with your seed, to grow the plants to the blooming stage; then they have to be carried through the winter in the bay window or a light cellar, for planting out in the spring.

But after all this trouble, there is still a more serious trouble. Carnations do not come true from seed. You have no possible means of knowing what color you are going to get, or whether your crop of flowers will possess any merit at all, as compared with the fine varieties now in cultivation. Many of your seedlings will have single flowers, no matter how much they cost, or how fine a strain they are claimed to be.

It is estimated that florists grow 10,000 seedlings annually, and out of this vast number there are not, on an average, over ten new carnations a year put upon the market as being better than, or as good as existing kinds. If you purpose to grow a few carnations, you want good ones. You must now see there is no hope of obtaining them from seed.

Your next and only source of first supply is from some professional carnation grower. When a fine carnation is obtained from seed, the variety is perpetuated by cuttings. Large carnation growers thus continue the kinds by the tens of thousands. They then know in advance the color and character of the flower they desire to have, and are familiar with the habits and peculiarities of the plants they obtain.

There are seven primary divisions of colors in carnations, suggested by the writer, twenty years ago, and now generally ac-

cepted, viz: Crimson, scarlet, pink, white, yellow, white-variegated and yellow-variegated.

Out of this list of colors select those you prefer and send your order for the same to a reliable carnation-growing florist.

I will give you later on the name of the varieties of each of the foregoing classes, which I deem best adapted for growing at home by amateurs.

After you receive your plants, say about the first of May, plant them out in any ordinary garden soil, from twelve to fifteen inches apart, each way. They will be rooted cuttings from four to six inches long and will be comparatively hardy. Keep them well cultivated through the entire season and neatly staked.

These rooted plants to bloom early, say by the 1st or 15th of June; the cuttings must have been taken from the parent plants early, say October or November of the previous fall.

Carnation growers always have such on hand for growing flowers for their own wants early, out of doors.

Now, after you have invested in the first purchase of plants, you doubtless would like to know how to continue your stock *without* the expense of repeating your purchase and *with* the interest of being your own propagator.

In October take cuttings off your growing plants. Side shoots are better than the main stem—slips from three to four inches long. Use a sharp knife, then stick them in clean sand, filled in a box three or four inches deep, set the box under the shade of a tree or on the north side of the house, water them well and frequently, and from fifty to seventy-five per cent of your cuttings will root. Florists, with more favorable conditions, expect to strike from ninety to one hundred per cent of their cuttings.

Another mode of continuing your stock is by layering. Take a stem of the number that will stool up from the crown of your plant, slit it about half off, bend it to the earth, peg it down with a twig or stick, and cover over the incised part with moist earth, and it will take root. This plan was at first pursued in this country, and is largely continued in Europe. It is called layer-

ing. The rooted layers will bloom very early the following season. When well rooted, they, as well as the rooted cuttings, should be 'potted in three or four inch pots, and carried through the winter in a semi-dormant state, in the cellar near a window, comparatively dry, but not killing dry. There is a vast difference between those two conditions of the soil, which degree cannot be described, but common sense must determine.

In the spring, from the 15 of April to the first of May, they should be transplanted in the border for blooming. This is the routine of cultivation that must be pursued. After a carnation plant has bloomed out doors, or in the house one season it is worthless; it has lived its life and by nature served its purpose and no attempt should be made to continue its useless existence.

I endeavor to give the plainest and most practical directions for the culture of carnations—my purpose being to show how they may be grown by anyone who is willing to devote a little time and trouble to their care.

Some kinds of carnations are hardier than others, some bloom earlier in the season than others, some develop their flowers best under glass, or in a greenhouse, others bloom grandly in their open borders. I will give a list of colors and kinds which are best suited for open cultivation, at the homes of those who choose to try them.

Out of the entire list of white carnations there is not one whose reputation for out-door growth is so well established as is that of Mrs. Fisher. This white variety is grown almost exclusively by florists for their open air carnation bloom. Its flowers are a pure white, large and deliciously fragrant. One can not do better than to grow it.

For pinks procure Diaz Albertina, Daybreak, Wm. Scott and Rose Queen. In carmine, select Tidal Wave; scarlet, Portia; white-variegated, Helen Keller and Goldfinch. In the pure yellows there is but little choice—Gold Nugget and Golden Triumph, and these are not very meritorious.

The two or three kinds of carnations which experience has proven to do the best in pots in the window of the sitting room

during winter months are Alaska, white; and Winter Cheer, rich vermillion.

I have not given a large list to select from—to do so would only tend to confuse. Neither have I mentioned the names of any of recent introductions because their reputation for out-door blooming is not yet well established. If an amateur desires a brief list on which rests the greatest expectation of carnation experts, let him order Cressbrook, Egypt, Norway, Mrs. Nelson, Estelle, Genevieve Lord, Queen Louise, Prosperity, Alba Superba, Mrs. Lawson, Mrs. Dean, and Marquis. The color, records, descriptions and half-tones of these and other choice varieties may be found on the pages of AMERICAN CARNATION CULTURE.

Carnation plants when received from the florist should be neatly and firmly planted in the border, and snugly staked as they develop in their growth.

Plants of the kinds which do not bloom profusely during the summer and fall months are the best to lift and pot for winter bloom. Five or six inch pots are necessary, and the soil in the pot should not be kept too wet at any time. The foliage should be frequently sprinkled with cold water and not kept in too warm a place.

Rooted carnation plants are cheap and bear transportation well. You can send for the young plants to a florist a thousand miles away. They can be received by mail, and if well rooted and cared for, every one of them will grow.

The range of colors attained in carnations is so great, the flower is so artistic, its grace so perfect, its duration so lasting, its fragrance so delicious, that it stands in the esteem of the lovers of flowers as "the sweetest smile of nature."

CHAPTER XXX.

EPILOGUE—EVOLUTION OF THE FIVE-PETALED PINK.

EVOLUTION is the grandest theme that ever engaged the mind of man. It is the history of creation, stepping by resistless law from a green Eden to a cindered world. It does not derogate from Deity, but magnifies omnipotence. Every man must have a loftier conception of the creative cause, who sees life as an act of God, and evolution as its law. One theory views God as an adventurer, without prevision, or prophecy, governing the world from contingencies as they arise. The other sees him as an omniscient ruler, trailing through duration a wise and inexorable law, that moulds worlds out of nebulae, cosmos out of chaos, and life out of latency. Darwin climbed this idea and built his throne on its simple truth. Under the law of evolution, orders, classes, genera and species of the vegetable kingdom, deploy themselves into serried ranks, by the imperious mandate of the best to persist, the fittest to survive, the strongest to endure, and no flower blooms without an object, no insect crawls on aimless feet, no man aspires without a purpose.

It was an act of amazing *power* to create a plant instinct with life, and one of measureless *wisdom*, to project a law by the thaumaturgy of which a noxious Blind Starwort should change into the humble five-petaled pink, seen by Theophrastus, that into the carnation of Alegatiere, and that into Dianthus Superba of the Twentieth Century. Man is a civilized savage, a carnation is an evolved weed. Heredity and progress are fighting forces, one advances, the other retreats. One cries "go!" the other "whoa!" One is history, the other prophecy; one lifts men to monarchs, the other lapses them to lazzaroni; one lifts a catchfly to a Lawson, the other would degrade it to a weed.

Carnations have kept abreast with the progress of the ages, in their marvelous march, and have ever advanced the standards



Courtesy of F. R. Pierson Co.

THE MARQUIS.

of excellence up toward the mountain's crest, where beauty dwells and toys with grace. Evolution sits sceptered in the throne room of a carnation's life, it is ambushed with its embryo in its seedbed of mealy albumen. Evolution hears the chimes of loftier life, counts the units of heat, and light that fate affords, then mounts to the summit of their annual average. A law of the universe is epitomized in this plant. The carnation is embodied evolution. It enacts the law in pantomime and sing its song without an accent.

A grain of corn hides in its germ food for millions. There are unborn forests in an acorn's cup, and a world of wonders corralled in a carnation's carpel.

There is not an instance in the world's botany in which a single variety of a genus of plants so completely absorbs the merits of an Order, and all its cognate species, as does the carnation. There are but three species of the *Dianthus* genus of plants, besides *Caryophyllus*, that bear a flower worthy of a glance. *D. Barbatus*, *D. Plumaris*, *D. Chinesus*, and their countless sports. The cognate relations of carnation are known as ragweed, starwort, catchfly lychnis, ragged robin, sticky weed, sandwort, mouse-eared pink, and scores of others too insignificant to sport even a vulgar name, which the grace and beauty of *Dianthus Superba* would entrance a seraph, if it was not gazing on a God.

There never was a Satrap with as many poor relations, or a Midas with such a multitude of impoverished peons. It is sovereign over the realm of flowers and rules a world of weeds.

There is a dynamic energy that centralizes sentiment and polarizes power. Every thing on earth tends to Alpine heights, or to tartarean depths, to mirific force, or ravishing beauty. The most chaotic contentions of life at last focalize themselves in a single brain, condense their issues into edicts and leap in epigrams from fire-touched tongues.

"Liberty or Death" is all there was between Lexington and Yorktown. "Union and Liberty," between Sumpter and Appomattox.

A sunburst of evolving floral beauty is all there is of carnations between Theophrastus and Charles Starr, the isle of Greece and Avondale.

There is a mysterious bond of union between painting and poetry, music and flowers. They are but different manifestations of the same master passion in the human mind. They sanctify the spot wherever they touch the dirt of earth.

A poet boy plowed the rugged hills beside the river Ayr, and they intone the songs of Robert Burns. Angelo frescoed the "Last Judgment" on the ceiling of the Sistine Chapel in Rome, with such thrilling realism, that the beholder stands palsied in the presence of the most mirific tragedy God can ever enact.

Melody caressed a poor man's child at Augsburg and Mozart, at the age of six, began to time the keyboard of the world's sweet sounds. Tactful fingers in cross-fertilization mixed life and orieny with mystic mordants in a crypt of conception, and Buttercup rainbows Avondale with the color wealth of all the zones.

Flowers are embodied sentiment, bits of sunshine tangled with life's shades, and heralds of a higher range of virtues. While science, that never throbbed a pulse of poetry with its Theodolite, is measuring the curves and angles of these mental marvels, religion with faultless prescience sees God behind them all.

Clothed in crimson and white, red and maroon, carmine and pink, purple and gold, Dianthus Superba, with flashing beauty, flings the perfumed smoke of spices from censers not lit with fire, and steps with matchless grace across the threshold of the Twentieth century, the unchallenged color, Queen of Flora.



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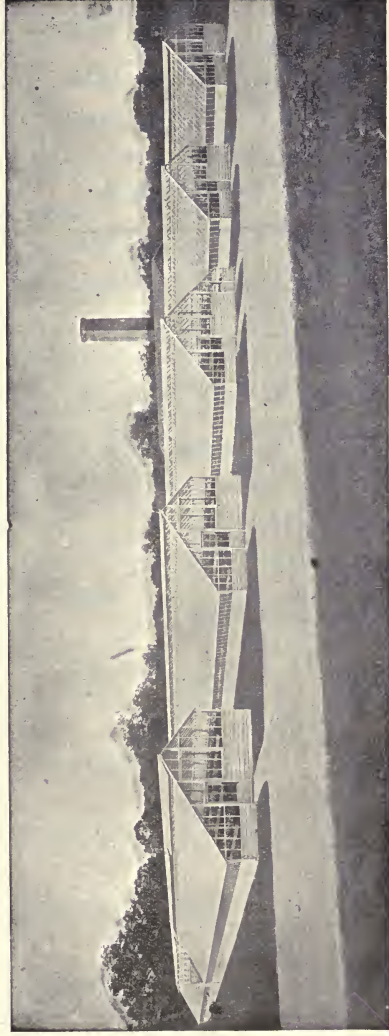
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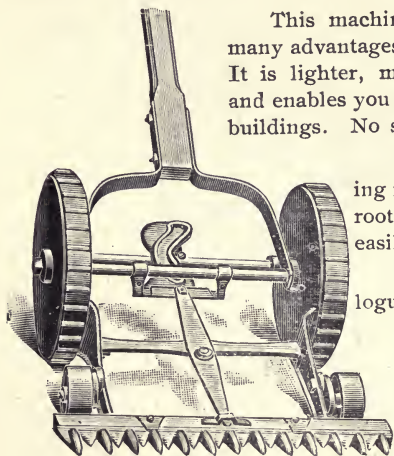
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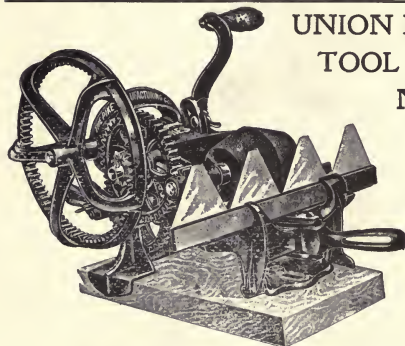
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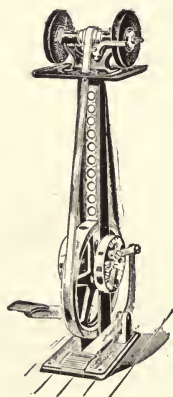


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